CARSON CITY PURCHASING & CONTRACTS
ATTACHMENT B
TECHNICAL SPECIFICATIONS

Document No. 1007 CLEARING AND GRUBBING (7/15/03)

1 General:

The project site will be cleared and grubbed by Contractor prior to the start of work. Any minor clearing and grubbing that may be required shall be completed as herein specified.

2 Clearing:

Clearing shall consist of the felling, trimming and cutting into sections any on-site tree not designated to remain and the satisfactory disposal of those trees, other vegetation designated for removal, downed timber, snags, brush, fences, asphalt and rubbish occurring within the areas to be cleared. Cut off flush with or below the original ground surfaces trees, stumps, roots, brush and other vegetation in areas to be cleared; except for trees and vegetation indicated or directed to be left standing. Saw cut existing asphalt to the lines designated on the plans. Completely remove fencing not designated to remain.

3 Grubbing:

Grubbing shall consist of the removal and disposal of roots larger than three (3) inches in diameter, matted roots, and designated stumps from the indicated grubbing areas. Excavate this material together with logs, organic and metallic debris, brush and refuse and remove to a depth of not less than three (3) inches below the original soil surface in areas indicated to be grubbed and in areas indicated as construction areas under this contract. Fill depressions made by grubbing with suitable material and compact to make the new surface conform with the existing adjacent surface of the ground.

4 Disposal of Cleared and Grubbed Materials:

All cleared and grubbed material will become the property of Contractor, and will be disposed off-site at an approved disposal location at Contractor’s expense.

END OF DOCUMENT 1007

Document No. 1008 EARTHWORK (5/30/01)

1 General:

Earthwork shall include all unclassified excavation and unclassified fill shown on the Plans. All work shall be per Section 303, Unclassified Excavation, and Section 304, Unclassified Fill, of the Standard Specifications.

2 Materials:

Onsite materials shall be re-arranged to accomplish the earthwork shown on the Plans. Imported material may be required to complete embankments.

END OF DOCUMENT 1008

Document No. 2001 STAKING, EXCAVATION, BACKFILLING AND COMPACTING FOR WATER LINES (7/5/07)

1 General:

1.1 Before any excavation on the project, Contractor shall notify all local utility companies and "Call Before You Dig" at 1-800-227-2600. Excavation shall include the removal of all materials or obstructions of any nature, the installation and removal of all sheeting and bracing and the control of water necessary to construct the work as shown. Excavation work shall be performed in a safe and proper manner with suitable precautions taken against hazards of every kind. Sheeting and shoring shall conform to the requirements of OSHA and Section 305.06 of the Standard Specifications. There is a significant likelihood that groundwater will be encountered during trenching excavation. Contractor shall be prepared to install and maintain pumping equipment necessary to control groundwater during construction.

1.2 Backfill during freezing weather shall not be done except by permission of Construction Manager. No backfill material shall be installed on frozen or yielding surfaces, nor shall frozen materials, snow or ice be placed in any backfill.

2 Reference Standards:

2.1 Relative compaction or density, when hereinafter referred to, means the in-place dry density of the soil expressed as a percentage of the maximum dry density of the same soil as determined by the ASTM D1557-91 test procedure. The costs of site compaction or density testing shall be paid for by Carson City. The costs of all retests (from failed tests) shall be paid for by Contractor.

3 Staking Out the Work:

3.1 Contractor shall retain a Nevada Licensed Professional Land Surveyor, and the Surveyor or his Subordinates shall stake out the horizontal and vertical positions of all the Work. Contractor shall satisfy himself as to the accuracy of all measurements before constructing any permanent structure and shall not take advantage of any errors found on the drawings. Where new construction connects to existing facilities, Contractor shall pothole and establish the exact locations and elevations prior to construction of the facilities.

3.2 It shall be Contractor’s responsibility to expose the existing water lines at the points of connection for the new lines and maintain the depths of cover and slopes as indicated on the drawings. It shall also be Contractor's responsibility to:

3.3 Pothole existing utilities and, after approval by Construction Manager, modify water line grade as required to match or avoid existing utilities while maintaining the depth of cover required and the general slope of the pipe to prevent high points in the pipeline.

3.4 Maintain the minimum amount of cover shown on the drawings, except as approved by Construction Manager.

3.5 Adjust depth of cover, after approval by Construction Manager, as required to prevent changes in the pipe slope which would create high points at locations other than those indicated on the drawings.

3.6 Have the Work staked in accordance with the lines and grades as shown on the drawings.

4 Trench Work:

4.1 Trench Configuration and Alignment:

4.1.1 Trenches shall be excavated to provide for the bedding as specified in subsection Bedding.

4.1.2 The new pipeline shall be laid essentially as per the alignments and grades shown on the

drawings.

4.1.3 Trenches and other excavations shall have the minimum width which Contractor can effectively excavate and install the improvements. Excessive widths will not be permitted. Trenches shall have a minimum width of twenty-four (24) inches greater than the outside diameter of the pipe to be installed. Deviations from this minimum width must be submitted to Construction Manager in writing for approval. The bottom of the trench shall be graded uniformly to provide a minimum cover of forty-two (42) inches over the top of the pipe unless otherwise shown on the drawings, provide continuous bedding support under the pipe, and to allow the pipe to be laid to the grades and alignments shown in the drawings.

4.2 Pipe Bedding:

4.2.1 The trench shall be over excavated to a depth of at least six (6) inches below the bottom of the pipe and backfilled to the required grade of the bottom of the pipe with bedding material. The pipe bedding shall be brought to optimum moisture content and compacted to not less than 90% relative density. The pipe bedding at the trench bottom shall have a flat or semicircular cross section. The bottom of the trench for all pipe shall be graded and prepared to provide a firm and uniform bearing surface throughout the entire length of each pipe section except for excavation required at joints. Pipe couplings shall not rest on the trench bottom and laying the pipe on mounds will not be allowed.

4.3 Bedding Through the Pipe Zone:

4.3.1 After center loading the pipe to prevent lateral movement, bedding material shall be placed in the trench simultaneously on each side of the pipe for the full width of the trench in layers not to exceed eight (8) inches in depth. Each layer or lift shall be compacted to at least 90% of maximum density evenly, on each side of the pipe throughout the pipe zone. The pipe zone is to extend from bottom of the pipe to twelve (12) inches above the top of the pipe and shall be backfilled with bedding material as specified herein.

4.4 Backfill Above the Pipe Zone:

4.4.1 From twelve (12) inches above the top of pipe to the top of the trench, if not in existing pavement, or bottom of the pavement structure, if in existing pavement, pipe backfill shall consist of material as specified in subsection Backfill. No oil cake, bituminous pavement, concrete, rock or other lumpy material shall be used in the backfill. Backfill material shall be compacted to not less than 90% relative density. All trenches shall be backfilled after pipe fittings and appurtenances have been installed, inspected and approved. All trash, wood, large rocks, waste material and other objectionable debris shall be removed from excavation prior to any material being placed in the trench. Backfill shall include the refilling and compacting of the trench or excavation.

4.4.2 Where existing underground pipes or conduits larger than three (3) inches in diameter cross the trench above the new work, the backfill from the bottom of the trench to the spring line of the intersecting pipe or conduit shall be Crushed Gravel Base material, Type 2, Class B, Aggregate Base conforming to the requirements of Section 200.01.03 of the Standard Specifications, compacted to 90% of maximum density. The aggregate base material shall extend two (2) feet on either side of the intersecting pipe or conduit which will insure that the material will remain in place while other backfill is placed.

4.4.3 Backfill by jetting shall not be allowed. Backfill shall be densified by mechanical compaction.

4.5 Site Excavation:

4.5.1 The bottom of the excavation shall not be more than one-tenth (0.10) foot above or below the lines and grades specified. If the elevation of structure excavation is not specified the excavation shall be not more than one-tenth (0.10) foot above or below the elevation specified for fill material below the structure. Cut slopes shall vary no more than five-tenths (0.5) foot from specified grade unless the excavation is in rock where the maximum variation should be two (2) feet. Unless otherwise specified, excavations shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation

of services, and for inspection, except where concrete is specified to be placed directly against excavated surfaces. Upon completion of excavation, the existing subgrade shall be compacted to a minimum of 95% relative density.

4.5.2 Should the excavation be carried below the lines and grades specified on the drawings, or should the bottom of the excavation be disturbed because of Contractor's operations and require over-excavation and backfill, Contractor, at his expense, shall refill such excavated space to the proper elevation in accordance with the procedure specified for backfill.

4.6 Rock Excavation and Blasting:

4.6.1 No blasting will be permitted without the approval of Construction Manager. When blasting is permitted, it shall be done only by skilled operators and under the direction of a competent, properly licensed foreman.

4.6.2 Blasting will be permitted only when proper precautions are taken for the protection of persons, the work, and existing structures. Any damage done to persons, private property, the work, or existing structures shall be the responsibility of Contractor.

4.6.3 Blasting shall be done with explosives of such power and in such quantities and positions as not to make the excavation unduly large, or to shatter the faces of cuts which are to remain open. Excessive blasting or "overshooting" will not be permitted, and any material outside the authorized cross-section which may be shattered or loosened by blasting shall be removed and replaced with earth as herein specified, at Contractor's expense. Construction Manager shall have authority to require Contractor to discontinue any method of blasting which leads to "overshooting" or is dangerous to the public or destructive to property or to natural features.

4.6.4 Permits for blasting shall be obtained and paid for by Contractor.

4.7 Sheeting and Shoring:

4.7.1 Excavation for trenches shall be properly and substantially sheeted, braced, and shored as required by trench conditions. Sheeting, bracing, and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure and shall be rigid, maintaining shape and position under all circumstances. Contractor’s design for all sheeting and shoring shall be signed and sealed by a licensed Nevada Civil or Structural Engineer and the drawings submitted to Construction Manager prior to its construction.

4.7.2 During backfilling, any shoring shall be carefully removed by Contractor in such a manner as will result in a minimum of caving, lateral movement, or flowing of the soil. On approval of Construction Manager, Contractor may leave shoring in place, but in such an event, no payment will be made by Carson City for such materials left in place. Where trench shoring is left in place, it shall not be braced against the pipe.

5 Materials:

5.1 Bedding:

5.1.1 Pipe bedding material shall conform to the requirements of Section 200.03.02, Class A Backfill, of the Standard Specifications.

5.1.2 Bedding shall be placed in accordance with Section 305.08, Bedding, of the Standard Specifications.

5.2 Backfill:

5.2.1 Trench backfill shall conform to the requirements of the Standard Specifications, Section

200.03.06, Class E Backfill, unless otherwise specified.

5.2.2 Trench backfill shall be placed and compacted in accordance with Section 305, Trench Excavation and Backfill, of the Standard Specifications.

5.2.3 Backfill for any structure shall be Crushed Gravel Base material, Type 2, Class B, Aggregate Base conforming to the requirements of Section 200.01.03 of the Standard Specifications. No backfill material shall be deposited against concrete structures until the concrete has developed a minimum strength of 3,000 psi.

5.2.4 If site excavated material meets the requirements for Class “E” Backfill but exceeds optimum moisture content, Contractor shall take whatever measures are necessary to dry the material to a compactable moisture content. No additional compensation shall be allowed for such measures. If site excavated material does not meet "Class E Backfill" requirements in accordance with the Standard Specifications, Contractor may be directed by Construction Manager to remove and dispose of the unsuitable material to an approved disposal location and import acceptable material.

5.3 Pavement Structure:

5.3.1 Defined as that section from the top of the backfill to the road wearing surface. This section shall consist of Crushed Gravel Base material, Type 2, Class B, aggregate base conforming to the requirements of Section 200.01.03 of the Standard Specifications, compacted to 95% maximum dry density overlaid with asphalt concrete at a depth to match contiguous pavement, but not less than that specified in roadway sections. Refer to the Permanent Pavement Patch Detail on the drawings, and if applicable, also refer to the Patching Details for Work within NDOT Right-of-Way.

6 Construction:

6.1 Maximum Length of Open Trench:

6.1.1 Except by permission of Construction Manager, the maximum length of open trench where prefabricated pipe is used, shall be five hundred (500) feet, or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is the greater.

6.2 Control of Water:

6.2.1 When water is encountered, Contractor shall furnish, install, maintain and operate all necessary machinery, appliances, and equipment to keep excavations free from water until the placing of the bedding material, laying and jointing of the pipe, pouring of concrete, and placing of the backfill material has been completed, inspected, and approved and all danger of flotation and other damages is removed. Groundwater pumped from the trench shall be disposed of in such a manner as will not cause injury to public or private property, or constitute a nuisance or menace to the public, and shall be subject to the prior approval of Construction Manager and all regulatory requirements of the State of Nevada. If well points are used for dewatering, they shall be removed or abandoned according to State of Nevada regulations.

6.3 Special Foundation Treatment:

6.3.1 Whenever the bottom of the trench is soft, yielding, or in the opinion of Construction Manager otherwise unsuitable as a foundation for the pipe, the unsuitable material shall be removed to a depth approved by Construction Manager and replaced with suitable material approved by Construction Manager. Payment for this work will be made only if the bottom of the trench has become unstable due to circumstances beyond the control of Contractor. Payment for this work will be made as specified in subsection 7.6.4 Modification Procedures of the General Conditions unless otherwise provided for in these Contract documents.

6.4 Restoration of Roadway Surfaces:

6.4.1 All road shoulders and pavement which are broken or damaged due to Contractor's operations shall be reconstructed by Contractor at no additional cost to Carson City. Reconstruction shall be subject to the approval of Construction Manager.

6.5 Repairs Required by Trench Settlement:

6.5.1 If, at any time during a one (1) year period from the date of final acceptance of the project, there is any settlement of the trenches requiring repairs to be made, or should any other defect appear in the system due to negligence or carelessness on the part of Contractor, Carson City will notify Contractor to immediately make such repairs as may be deemed necessary at Contractor's expense.

6.6 Surplus Material:

6.6.1 All surplus material shall be disposed of off site in accordance with applicable ordinances and environmental requirements. Contractor shall be responsible for ultimate disposal of surplus material. He shall also include in his bid the cost for disposal, in accordance with City, State, and Federal environmental laws, of all Asbestos Cement Pipe removed during construction.

END OF DOCUMENT 2001

Document No. 2002 WATER SERVICE CONNECTIONS (8/26/04)

1 Scope:

1.1 The work to be done under this Section consists of furnishing all labor, equipment, materials, supplies and incidentals necessary for installation of water service connections, and fire service connections.

2 Materials:

2.1 Service Connection Size:

The size of service connections shall be as shown on the construction drawings. All components of a service connection shall be the same size as the nominal designation of the service connection pipe; i.e., a one (1) inch connection will consist of a one (1) inch service saddle, and a one (1) inch corporation stop, unless otherwise shown on the drawings.

When replacing an existing service connection, if the existing service size encountered is larger than the existing service shown on the drawings, and the drawings do not indicate to replace to the larger size, the service shall be replaced to match the existing service. Contractor shall be compensated for the increase in size.

Service Saddles:

Service Saddles shall be manufactured specifically for the type and size of pipe upon which they are being used. The Service Saddle bodies shall be stainless steel or dipped fusion bonded epoxy coated ductile iron.

The bands (straps), nuts, and bolts shall be of 18-8 stainless steel. The bands of D.I. saddles shall be two (2) inch wide. One band shall be supplied for up to one (1) inch service sizes and two (2) for over one (1) inch. The gasket shall be constructed of Buna-N or Neoprene. The inlet threads shall be AWWA I.P. Thread.

Corporation and Curb Stops:

Corporation stops shall be constructed of brass (Red Brass 85-5-5-5) and have AWWA I.P. Threads inlet and outlets suitable for flared connections to PE pipe. Corporation and curb stops shall be manufactured by Ford, Mueller or approved equal. Curb stops shall be the inverted key type, constructed of brass.

Meter Pit Setters and Boxes:

Meter pit setters for 3/4 “ and 1" meter installations shall be the Carson City Standard Mueller/McCullough Thermal-Coil Meter Box complete with integral riser, inlet angle valve, and outlet check valve. Pit setter shall be fifteen (15) inches minimum diameter for single 3/4 “ meter installations, and eighteen (18) inches minimum for double 3/4" meter installations and single 1" installations. Pit setters for 1-1/2" and 2" meter installations shall be as shown on the drawings.

Meter boxes for 3" to 8" meter installations shall be the Carson City Standard Christy B52 with M3 lid or as shown on the drawings.

3 Workmanship:

3.1 General:

3.1.1 Contractor shall install the water service; make all connections as required to the main, connection to the new meter service, and connection between the new meter and the building supply line or irrigation supply line as indicated on the drawings.

3.2 Installation:

3.2.1 Prior to installing the service saddle or tapping sleeve, remove all dirt or other foreign matter that may impair the quality of the completed connection. Then place service saddle or tapping sleeve at the desired location but not within eighteen inches (18") of any fitting, coupling, valve, bend, or end of pipe. Tighten as per manufacturer's recommendation.

3.2.2 Tubing shall be cut with square ends, reamed and flared with the proper size flaring tool, cleaned, and made up tightly. Care shall be taken to prevent the tube from kinking or buckling on short radius bends. Kinked or buckled sections of tube shall be cut out and the tube spliced with the proper brass fittings, at Contractor's expense. All fittings, including reducers, shall be brass.

3.2.3 Connections between the new service, building supply line or irrigation supply line, and existing service or supply lines shall be neat and watertight with adequate pipe to prevent stress at joints.

3.3 Existing Meter Relocations:

3.3.1 Contractor shall, ONLY in the presence of the Carson City Inspector, remove individual meters from the existing pit setter or meter set, and immediately relocate the meter to the new pit setter or meter set. Domestic meters shall be relocated so that they serve the same domestic building supply line as before the relocation. Irrigation meters shall be relocated so that they serve the same irrigation supply line as before the relocation.

3.4 New Meter Installations:

3.4.1 Contractor shall obtain from Carson City a no cost Permit for a new meter installation. Upon completion of the water service installation and acceptance of all testing and inspection of the new water service and any applicable water main, Contractor shall submit a completed "Utility Billing Water/Sewer Service Application" to Construction Manager. Carson City will then install the new meter.

END OF DOCUMENT 2002

Document No. 2003 POLYETHYLENE TUBING (3/15/07)

1. General:

1.1 This section covers polyethylene tubing which shall be furnished and installed complete and in place with all jointing materials, fittings and other appurtenances as shown on the Plans or as otherwise required for a complete installation.

2. Materials:

2.1 Tubing:

2.1.1 Polyethylene tubing shall conform to NSF Standard No. 14, AWWA Standard C901, and to the specifications of ASTM D 2737. Polyethylene tubing shall be copper tubing size (CTS) , pressure class 200, have a dimension ratio (DR) of not more than 9.0, and shall be made with materials designated PE3408 by the Standard PE Code.

2.1.1 All repairs or connections to new or existing P.E., copper or galvanized water service lines, “to 2", shall be MUELLER CTS 110 COMPRESSION TYPE FITTINGS OR APPROVED EQUAL.

2.2 Fittings:

2.2.1 Fittings shall meet the requirement set forth in AWWA C901 and shall be Flare-Nut type.

3. Installation:

3.1 Polyethylene tubing shall be installed in accordance with the manufacturer's recommendations and in accordance with AWWA C901.

END OF DOCUMENT 2003

Document No. 2004 TAPPING SLEEVES AND SERVICE SADDLES (10/5/01)

1 General:

This section specifies tapping sleeves (For four (4) inch pipe or larger) and service saddles (For pipe sizes less than four (4) inches) to be installed for hot tapping of potable water mains. ALL HOT TAPS GREATER THAN TWO INCHES (2") PERFORMED ON FOUR INCH (4") OR GREATER POTABLE WATER MAINS ARE TO BE PERFORMED BY CARSON CITY PUBLIC WORKS DEPARTMENT.

2 Tapping Sleeves:

2.1 Shall be constructed of the following materials:

ITEM	MATERIAL
Shell & Lugs	18-8 Type 304 Stainless Steel.
Flange	18-8 Type 304 Stainless Steel or high tensile ductile (nodular) iron conforming to ASTM A536-80, Grade 65-45-12.
Welds	Fully passivated for corrosion resistance.
Bolts	5/8" Diameter, 18-8 Stainless Steel National Course rolled thread, fluorocarbon coated to prevent galling.
Nuts & Washers	18-8 Stainless Steel.
Gasket	Virgin styrene butadiene rubber compounded for water service conforming to ASTM D2000-80MA AAA607 with 360 degree pipe coverage. Working pressure: 150 p.s.i.

3 Service Saddles:

Shall be constructed of the following materials:

ITEM	MATERIAL
Welds	Fully passivated for corrosion resistance.
Bands & Bolts	5/8" Diameter 18-8 Stainless Steel National Course rolled thread, fluorocarbon coated to prevent galling.
Nuts & Washers	18-8 Stainless Steel.
Finish	Approximately twelve (12) mils of fusion applied epoxy coating conforming to AWWA 213-91.

4 Installation:

Tapping sleeves and service saddles shall be located as shown on the plans and installed in accordance with the manufacturer's recommendations. Tapping sleeves 4" and larger shall have a thrust block and the concrete used for thrust blocking shall not prevent access to the bolt assembly. Tapping sleeves and service saddles shall, in all respects, be constructed similar to the Romac brand or approved equal, meeting material requirements specified within this section.

The tapping sleeve shall be pressure tested to the class rating of pipe for a minimum of 5 minutes prior to hot-tap. The pressure tests shall be performed in presence of a Carson City Public Works Department staff member.

Contractor shall give written notice, either hand delivered or by fax, to Construction Manager five (5) working days prior to the performance of any Hot-Taps by Carson City. (Carson City Public Works, 3505 Butti Way, Carson City, Nevada 89701, Fax # (775) 887-2112.

END OF DOCUMENT 2004

Document No. 2005 POLYVINYL CHLORIDE PIPE (5/10/05)

1 General:

1.1 This section covers pressure water supply polyvinyl chloride pipe which shall be furnished and installed complete with all jointing materials, fittings and other appurtenances shown on the drawings or otherwise required for a complete installation. Contractor shall furnish, install and test pipe, fittings and appurtenances of the dimensions and types and to the lines and grades shown on the drawings and specified herein.

2 Unloading PVC Pipe:

2.1 Prolonged exposure to temperatures near freezing make PVC sensitive to impact and extra care shall be taken in handling PVC during cold weather.

2.2 PVC pipe may be off-loaded by hand, either by passing over the side or off the truck end. Sliding one (1) length on another is standard practice in unloading PVC pipe, but lengths in the bottom layer shall be lifted off of the rough surface of the truck body to avoid erosion.

2.3 Compact shipping units (palletized bundles in a wood frame) are used to ship large orders of pipe. These units can be unloaded by conventional fork lifts.

3 Materials:

3.1 Pressure Pipe:

3.1.1 PVC pressure pipe shall conform to AWWA C900 or C905, as shown on the drawings. Pressure class for C900 or pressure rating for C905 shall be as shown on the drawings and have an outside diameter equivalent to that of cast iron pipe. The standard pipe length shall be twenty (20) feet.

3.1.2 Identification Marks:

3.1.2.1 Pipe and couplings shall be clearly and permanently marked with all information required by AWWA C900 and AWWA C905, respectively.

3.1.3 Testing:

3.1.3.1 All materials shall be sampled and tested in accordance with all requirements of AWWA C900 and AWWA C905, respectively. Pipe not manufactured in the United States shall be tested as required above by an approved testing laboratory within the United States.

3.1.4 Affidavit of Compliance:

3.1.4.1 The manufacturer shall furnish an affidavit of compliance certifying that all tests have been conducted and that the materials comply with the applicable standards and these specifications. Test information shall be retained and shall be available if required by Engineer.

3.1.5 Couplings:

3.1.5.1 Each length of pipe shall be furnished with a coupling consisting of either a PVC sleeve and two (2) sealing rings or an integrally cast bell and one (1) sealing ring designed to hold the pipe in alignment, provide flexibility, separate the ends of the pipe lengths, resist applied earth pressures and provide fluid tightness.

3.1.6 Rubber Rings:

3.1.6.1 Rubber rings shall conform to Subsection 203.15.03.01 of the SSPWC.

3.1.7 Fittings:

3.1.7.1 Fittings shall be PVC, or short body gray iron, or ductile iron conforming to ANSI A21.10 (AWWA C110). Cast iron fittings for pipe twelve (12) inches and smaller shall be pressure rated for 250 psi. Ductile iron for fittings shall conform to ASTM A536 Grade 80-60-03 or 70-5-05 and fittings for pipe twenty-four (24) inches or smaller shall be pressure rated for 350 psi.

3.1.8 Joints:

3.1.8.1 Flanged Joints:

3.1.8.1.1 Flanges shall conform to ANSI B16.1 and shall be 250 psi, flat-faced. Bolts shall be of corrosion-resisting steel conforming to the requirements of ASTM A193, Grade B7. Bolts shall conform to ASTM A194, Grade 2H Heavy Series. The fit shall be free fit (Class 2), except that medium fit (Class 3) shall be provided in holes tapped for studs. Bolts and nuts used for submerged service shall be made from Type 304 stainless steel and shall conform in design to the above specifications.

3.1.8.1.2 Studs and bolts shall be of such length that no less than 1/4 inch nor more than 1/2-inch will be projected through the nut when drawn tight. All bolt heads and nuts shall be hexagonal except where special shapes are required.

3.1.8.1.3 Gaskets shall conform to ASTM D1330, Grade I, red rubber, ring type, 1/8-inch thick.

3.1.8.2 Mechanical Joints:

3.1.8.2.1 Mechanical joints shall conform to ANSI A21.11.

3.1.8.2.2 Push-on Joints:

Push-on joints shall conform to ANSI A21.11 except that gaskets shall be neoprene or other synthetic rubber. Push-on joints shall have their ring grooves and rings compatible with the pipe ends. The grooves shall be gauged for tolerance before arriving at the job site and the grooves and interior surfaces of the bell shall be smooth and free from ridges, notches and uneven surfaces.

4 Installation:

4.1 General:

Installation shall conform to the manufacturer's recommendations except as modified by these specifications and as shown on the drawings.

All laying, jointing and testing for defects and leakage shall be performed in the presence of Engineer and shall be subject to his approval before acceptance. Materials found during construction to have defects will be rejected and Contractor shall promptly remove such defective material from the site.

5 Trenching, Bedding and Backfill:

Requirements for trenching, bedding and backfill shall be as specified; as required by applicable permits and regulations; and as required by applicable safety codes.

Pipe shall be laid on a shaped trench foundation or shaped bedding as required and with properly dug bell or coupling holes. Supporting pipe on blocks or mounds of earth or bedding material will not be permitted.

6 Handling and Stockpiling:

Pipe, fittings and accessories shall be handled in a manner that will insure installation in a sound,

undamaged condition. Equipment, tools and methods used in unloading, reloading, hauling and laying pipe and fittings shall be such that the pipe and fittings are not damaged. Hooks inserted in ends of pipe shall have broad, well padded contact surfaces. No unpadded hooks or wire brushes shall be permitted to contact plastic lining. Pipe and fittings in which lining has been broken, split or loosened shall be replaced by and at the expense of Contractor. Where damaged areas are small and readily accessible, Contractor may be permitted to repair the lining in accordance with the manufacturer's instructions. Store pipe on a flat surface so as to support the barrel evenly. Store random lengths separately where they will be readily available. Individual lengths of pipe should be stocked in piles of no higher than three (3) feet. If pipe is to be stored outside for periods longer than thirty (30) calendar days, the pipe must be covered to protect it from prolonged exposure to the sun's rays. The pipe shall be covered with canvas or another opaque material which shall not be clear plastic sheets. Provisions shall be made for air circulation under the sheet.

6.1 Cutting:

Cutting and machining of pipe shall be accomplished in accordance with the pipe manufacturer's standard recommendations. Pipe shall not be cut with a cold chisel, flame, standard iron pipe cutter, nor any other method that may fracture the pipe, produce ragged, uneven edges or split the pipe end. Cut ends shall be machined smooth to the proper dimensions.

7 Pipe Laying:

The pipe shall be laid to the lines and grades shown on the drawings and specified herein and the sections shall be closely jointed to form a smooth flow line. Immediately before placing each section of pipe in final position, the bedding shall be checked for firmness and uniformity of surface.

The radius of curvature of the trench shall determine the maximum length of pipe section that can be used without exceeding the allowable deflection at a coupling. The deflection at any flexible joint shall not exceed that prescribed by the manufacturer of the pipe. The manufacturer's printed installation guide outlining the radii of curvature that can be negotiated with pipe sections of various lengths shall be followed.

Proper implements, tools, and facilities as recommended by the pipe manufacturer's standard printed installation instructions shall be provided and used by Contractor for safe and efficient execution of the work. All pipe, fittings, valves, and accessories shall be carefully lowered into the trench by means of derrick, ropes, or other suitable equipment in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective, damaged or unsound pipe shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after laying. All openings on the pipe line shall be closed with watertight expandable type sewer plugs or test plugs at the end of each day's operation or whenever the pipe openings are left unattended. The use of burlap, wood, or other similar temporary plugs will not be permitted.

8 Distributing Along the Trench:

Pipe should be strung as near the trench as possible, but, if the trench has not been dug, it shall be kept out of the way of the excavator. It shall be protected from blasting, traffic, equipment or other hazards. Where damage as a result of vandalism could occur, only enough pipe for one day's laying shall be strung. The pipe shall be strung so that the bell ends point in the direction that the work is progressing.

9 Jointing:

Each pipe joint shall be joined either with a coupling consisting of a PVC sleeve and two (2) rubber gaskets, or an integral bell with one (1) rubber gasket.

The gasket and the gasket seat inside the collar or bell shall be wiped clean before the gasket is inserted. At this time a thin film of lubricant shall be applied to the gasket and to the outside of the clean pipe end. Lubricant other than that furnished with the pipe shall not be used. The end of the pipe shall be then forced into the collar or bell to complete the joint.

The assembly of the joint shall be made in accordance with the printed recommendations of the manufacturer. This shall be accomplished with an assembly tool if so recommended by the manufacturer, so that the resulting position of the sleeve shall be such that is centered over pipe ends. After assembly of the coupling, the rubber gasket location shall be checked with a suitable gauge. Gaskets for the full circumference of the pipe shall be located at a distance from the coupling or bell end as recommended by the manufacturer of the couplings, if the distance does not fall within required limits, the joint shall be disassembled and reassembled in an acceptable manner.

When pipe laying is not in progress, the open end of the pipe shall be closed by approved means to prevent trench water from entering pipe. Adequate backfill shall be deposited on pipe to prevent floating of pipe. Any pipe which has floated shall be removed from the trench, cleaned, and relaid in an acceptable manner. No pipe shall be laid when, in the opinion of Engineer, the trench conditions or weather are unsuitable for such work.

10 Installations of Fittings:

Fittings shall be installed utilizing standard installation procedures. Fittings shall be lowered into trench by means of rope, cable, chain, or other acceptable means without damage to the fittings. Cable, rope, or other devices used for lowering fitting into trench, shall be attached around exterior of fitting for handling. Under no circumstances shall the cable, rope or other device be attached through the fitting's interior for handling. Fittings shall be carefully connected to pipe or other facility, and joint shall be checked to insure a sound and proper joint.

11 Thrust Blocking:

Concrete thrust blocking shall be provided at all tees, elbows, wyes, caps, valves, hydrants, reducers, and other points of unbalanced thrust. Thrust blocking shall be poured so the thrust surface bears against undisturbed soil. Thrust blocking shall be as specified in Document No. 2013 Thrust Blocks of these Technical Specifications.

END OF DOCUMENT 2005

Document No. 2006 DUCTILE IRON PIPE (6/22/04)

1. General:

Ductile iron pipe shall be installed in the locations and of the sizes shown on the drawings.

1.2 Materials:

1.2.2 Pipe:

Unless otherwise stated, all ductile iron pipe shall be Pressure Class 150, or greater, conforming to the requirements set forth in AWWA C151.

1.2.3 Fittings:

Ductile iron fittings shall meet the requirements set forth in AWWA C110.

1.2.4 Joints:

Push-on and mechanical joint rubber gasket joints shall meet the requirements of AWWA C111.

When the type of joints indicated on the drawings are flanged, flanges shall meet the requirements of AWWA C207.

1.2.5 Installation:

Ductile iron pipe shall be installed in accordance with the manufacturer's recommendations and in accordance with AWWA C600.

1.2.6 Linings and Coatings:

All ductile iron pipe and fittings shall be cement-mortar lined in accordance with AWWA C104.

The exterior of exposed ductile iron piping including valves, etc., shall be painted as specified in Document 7001 Painting of these Technical Specifications. Surface preparation shall be in accordance with the manufacturer's recommendations.

The exterior of buried ductile iron pipe including flanged joints, tees, etc., shall be wrapped and sealed with (2) two layers, of a minimum thickness each layer, 8 mil polyethylene film per AWWA C105.

END OF DOCUMENT 2006

Document No. 2007 GALVANIZED STEEL PIPE (5/29/01)

1. General:

This section specifies galvanized steel pipe to be used where called out on the Plans.

1.1 Materials:

Pipe and fittings shall be galvanized steel 150 lb. standard weight, hot dip galvanized conforming to ASTM A 120. Fittings shall be malleable screwed type, conforming to ANSI B 16.3. Nipples shall be extra strong (Schedule 80); "close nipples" will be permitted only by special authorization in each case.

1.2 Installation:

Contractor shall install all pipe, fittings, valves and appurtenances as shown on the plans, including couplings, jointing materials and pipe supports. Piping shall be adequately supported with pipe support as shown on plans or approved equal.

1.3 Pipe Protection:

Upon completion of the work, Contractor shall wrap the pipe with a 10 mil polyethlylene film.

END OF DOCUMENT 2007

Document No. 2008 COATING EXTERIOR METAL PIPE (5/16/05)

1. General:

Contractor shall furnish all labor, materials and equipment necessary to provide protective coatings as specified or required. All coating thicknesses described herein refer to dry film thickness. Finish colors shall be selected by Engineer and color samples shall be furnished for review.

1.2 Coating Metal Pipe:

Metal pipe shall be coated with a high gloss alkyd paint system. Colors for color coding of pipe shall be as specified above. Metal pipe shall be power tool cleaned per SSPC-SP-3 or commercial blast cleaned SSPC-SP-6.

1.3 Alkyd System:

The alkyd system shall consist of (2) two or more finish coats applied over a primer to a total dry film thickness of not less than seven (7) mils. Paint shall consist of not less than 35% solids by volume and 25% pigment by weight. Finish systems shall be the following or approved equal.

1.4 Koppers:

Apply one (1) coat of Koppers 622 Rust Penetrating Primer to black iron or steel or one (1) coat of 622 Rust Penetrating Primer to galvanized surfaces after pretreatment followed by two (2) or more coats of Rustarmor 500 Enamel.

1.5 Sherwin-Williams:

Apply one (1) coat of Sherwin-Williams Kromik Metal Primer E41 N to black iron or steel or one (1) coat of Galvanized Iron Primer B50 A 1 after pretreatment to galvanized surfaces followed by two (2) or more coats of Kem Lustral Enamel Series F65.

END OF DOCUMENT 2008

Document No. 2009 GATE VALVES (5/24/04)

1. General:

This section specifies underground gate valves and appurtenances to be installed on water or reclaimed water mains where shown on the drawings in accordance with the Carson City Standard Details “C-10.1, Gate Valve” and “C-10.3, Valve Box & Lid”.

Gate Valves shall be American AVK, American Flow Control, Clow, M & H, Mueller or equal resilient-seated gate valves conforming to AWWA C509 or C515 and shall be UL listed and FM approved.

2. Design:

Valve shall be non-rising stem (NRS) wedge type resilient-seated with O-Ring stem seals and low zinc copper alloy or stainless steel stem, equipped with a two (2) inch standard operating nut. Ends shall be designed for direct connection to the type of pipe or fitting which the valve is adjoined to, or as shown on the drawings. Valves shall open when turned counterclockwise.

The minimum design working pressure for valves twelve (12) inches in diameter and smaller shall be 200 psig and shall be 150 psig for larger valves. Valves shall be designed to have full port opening for unrestricted flow. The valve waterway shall be smooth and shall have no depressions or cavities in seat area.

3. Valve Boxes:

Concrete valve boxes with cast iron covers shall be provided for all buried valves. Valve boxes shall be provided with colored PVC (schedule 40 minimum) extension sleeves. Valve box covers shall be labeled, with pick hole access. Valve boxes and covers shall be Christy G5 traffic valve box with G5C lid, or approved equal.

4. Installation:

Valves shall be installed as shown on the drawings with support block and valve box and riser. Valves shall be installed with valve box centered over operating nut and plumb.

All valves shall be operated by Contractor prior to and following installation to assure free movement, proper seating and full-port opening.

5. Protective Coatings:

Valves shall be provided with a shop-applied fusion-bonded epoxy coating on interior and exterior surfaces conforming to AWWA C550.

Any damage to the protective coating including scratches, nicks, etc. shall be repaired prior to the installation using an approved coating conforming to AWWA C509 Sec. 4.2.2.8. or AWWA C515 Sec. 4.2.2.6.

All exposed metal on valves and fittings such as nuts and bolts including damage during installation shall be coated prior to backfill with an approved coating conforming to AWWA C509 Sec. 4.2.2.8 or AWWA C515 Sec. 4.2.2.6.

6. Valve Identification:

All valves located outside the pavement structure shall be identified with a Utility Marker. Water valve makers shall be blue Carsonite Utility Marker (CUM - 375), 5'-2" with blue valve decal (CWV 116) or approved equal. Marker shall be installed no more than 5 feet from the valve measured perpendicular to the water main or roadway.

END OF DOCUMENT 2009

Document No. 2010 CHECK VALVES (9/18/07)

1. General:

Check valves shall be installed in the locations shown on the plans and shall conform to the types and sizes as shown on the plans.

2. Wafer Style Silent Check Valves:

Silent wafer check valves shall be of the silent operating type which will reduce or eliminate water hammer shock. The valves have cast iron bodies, bronze seats, bronze bushings and stainless steel torsion springs. The disc shall be constructed of 304 Stainless steel for 2" through 12" and B62 Bronze for 14" through 24" sizes. The valve body shall be one piece and incorporate a Nitrile/EPDM seal which will seal at both high and low pressures and a disc that over laps the seal to prevent wear. The valves must be capable of vertical and horizontal operation; flow up or flow down. Wafer check valves shall be 150 psi class minimum, ANSI class 125 flanges and be similar in all respects to the Model 888 as manufactured by the FLOMATIC Corporation, or approved equal.

2.1 Swing Check Valves:

These valves shall be a spring assisted and cushioned wafer-style swing check valve which will provide a positive, drip-tight closure. The valve body shall be cast iron (ASTM A126, Class B grey iron) with Stainless Steel nuts and bolts and tapped bosses. The valve shall have a bronze clapper arm with a rubber (ASTM D2000) faced cast iron disk. The valves up to and including 12" shall be designed for a 175 psi working pressure, valves 14" and larger shall be designed for a 150 psi working pressure, fit ANSI B16.1, class 125 flanges and be similar in all respects to the Mueller Spring Assisted Cushioned Swing Check Valves, or approved equal.

2.2 In-Line Silent Check Valves:

These valves shall be fully automatic silent check valves using a spring loaded configuration for installation in a vertical position. The valve follower shall be equipped with a anti-spin lug to prevent back-flow and shall use an elastomer seat. The valve body shall be annealed ductile iron of sufficient strength to support the full weight of a riser pipe and submersible pump below. The valve body shall also be equipped with a break off plug and all fasteners and springs shall be stainless steel. Sizes 5" and larger shall have a ½" lead-in before the threads to assist with alignment. Flanged models shall meet ANSI 125. All in-line check valves shall be similar in all respects to the Model 80DI as manufactured by the FLOMATIC Corporation, or approved equal.

3. Installation:

All check valves shall be installed in accordance with the manufacturer's recommendations.

4. Protective Coating:

All check valve shall be supplied with a fusion bonded epoxy coating on both the internal and external surfaces of the valve with a minimum thickness of 10 mils.

END OF DOCUMENT 2010

Document No. 2011 BUTTERFLY VALVES (10/13/03)

1. General:

Contractor shall furnish all valves in accordance with the drawings and specifications. All valves, including component parts thereof, shall equal or exceed the requirements set forth herein.

Butterfly Valves shall be suitable for potable water and manufactured by a firm normally engaged in the manufacture of such valves. Butterfly valves shall be manufactured by Pratt, Mueller or approved equal. Valves shall be constructed of the following materials:

ITEM	MATERIAL
Body	A-36 Steel
Disc	A-36 Steel
Shaft	304 Stainless Steel
Seats	Synthetic Rubber
Bearings	Sleeve-Type

2. Design:

Butterfly valves, butterfly valve operators, and component parts thereof shall conform to the following standards, except as otherwise specified in these specifications:

(1) AWWA C504, Rubber-Seated Butterfly Valves.
(2) ASTM A276, Stainless and Heat-Resisting Steel Bars and Shapes.
(3) ASTM A436, Austenitic Gray Iron Castings.
(4) ASTM B 62, Composition Bronze or Ounce Metal Castings.
(5) AWWA C550, Protective Interior Coatings for Valves and Hydrants.

All butterfly valves shall be Class 150B and shall be short-bodied unless otherwise shown on the drawings.

Valves shall be furnished with flanged ends, hub ends, "Ring Tite" ends or any combination thereof as required by the drawings or these specifications. Valve flanges may be raised or plain faced with either a smooth or serrated finish and shall be faced and drilled to ANSI B 16.1, Class 125 cast iron flange dimensions, unless otherwise shown on the drawings or specified in these specifications.

All interior bronze parts of valves shall conform to the requirements of ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings, unless otherwise required by these specifications or shown on the drawings.

All valves shall be provided with an interior and exterior protective coating in accordance with subsection Protective Coatings.

Butterfly valve discs shall be manufactured of any of the materials listed in Section 3.4 of AWWA C504, except bronze. Prior to application of the required coating, any casting holes in the disc shall be plugged.

Butterfly valve seats shall be removable and replaceable while installed in the pipeline for valves 24 inches in diameter and larger. The rubber seat shall be applied to either the valve body or the disc. If the rubber seat is applied to the disc, the rubber seat shall be secured to the disc by means of cap screws by one of the two following methods:

If the cap screws penetrate the rubber seat, the cap screws shall bear against a metal retaining ring which shall be an integral part of the rubber assembly. The metal retaining ring shall be applied to the rubber seat by vulcanizing or bonding process in such a manner that the metal retaining ring and the rubber seat are installed and removed as a single unit.

If the cap screws do not penetrate the rubber seat, a portion of the rubber seat shall be installed in a groove or recess in the disc, and the metal retaining ring shall then bear upon that portion of the rubber seat that is installed in the groove or recess.

For the applicable above method Contractor shall furnish Engineer with the manufacturer's specified torque to be used to set the cap screws, or clearance to be attained between the rubber seat and the mating surface when replacing or adjusting the rubber seat.

The inside flow diameter (smallest flow area not including any portions occupied by the seat) shall not be less than 1-½ inches smaller than the nominal diameter. On valves larger than 24-inches in diameter, discs shall be mechanically secured to the shaft with Type 304 stainless steel, straight through taper pins and locking nuts.

Surfaces that mate with the rubber seat of a butterfly valve to effect the valve closure shall be stainless steel ASTM A276, Type 304 or 316, or an alloy of nickel-chromium (nichrome).

Shaft seals shall be designed for the use of standard split "V" type packing or standard O-ring seals.

Valves shall be bubble tight with rated pressure applied from either side of the valve. Valves shall be bi-directional for control of flow from either direction.

There shall be no travel stops for the disc on the interior of the body.

3. Operators:

Butterfly valve operators and component parts thereof shall conform to the following standards, except as otherwise specified in these specifications:

AWWA C504, Rubber-Seated Butterfly Valves.

ASTM B 62, Composition Bronze or Ounce Metal Castings.

3.1 Manual Operators:

Butterfly valves shall be provided with counterclockwise opening manual operators. The operating torque of each valve and operator shall be computed in accordance with the Appendix of AWWA Standard C504 for a velocity of 16 fps and the applicable pressure drop across the valve. The operators shall be sized for bi-directional flow.

Butterfly valve operators shall produce required torque with a maximum handwheel pull of 80 pounds for handwheels and chainwheels and 150 for operating nuts.

Handwheels shall be from 18 to 24 inches in diameter for valves through 54 inches in size. Handwheel sizes shall conform to detail drawings in checking for adequate operating space.

Butterfly valve operators shall have totally enclosed, permanently lubricated and sealed gear reducers.

All operators shall be self-locking with open and close stops provided to limit valve disc travel.

The maximum and minimum number of revolutions of the operator input shaft to open or close each valve shall be in accordance with the following table:

NOMINAL VALVE SIZE	MINIMUM NO. OF REVOLUTIONS	MAXIMUM NO. OF REVOLUTIONS
10	28	36

Calculations for valve torque requirements shall be submitted to Engineer as part of the shop drawing submittal package.

Valve operators shall be as manufactured by Limitorque Corp., Auma Actuators, Inc., or EIM.

Butterfly valves shall have totally enclosed, permanently lubricated, watertight, greased-packed operators.

All butterfly valves which are not directly buried or submerged, shall be provided with manual handwheels and position indicators. Valves shall be installed with the valve shaft in a horizontal position unless otherwise specified in these specifications.

All butterfly valves which are directly buried or submerged, shall be provided with a 2 inch square operating nut and shall not be equipped with a position indicator unless otherwise specified in these specifications.

Traveling-nut operators will not be permitted on valves 24-inches in diameter and larger.

Where shown on the drawings for valves located in vaults and as required to provide adequate clearance for the handwheel, the valve operator shall be provided with an external packing bonnet. The handwheel and operating nut shall be oriented as shown in the drawings and shall permit the connection of a standard valve key to a 2-inch square operating nut located in the center of the handwheel. Operation with the valve key shall be possible without removal of the handwheel.

3.2 Motor Operators:

Motor-operated butterfly valves shall consist of a motor-driven and manual valve-operating mechanism. Motor-operated butterfly valves shall have a worm gear assembly for motor and manual operation. All valve-operating mechanisms shall have an electric motor, handwheel, geared limit switch, torque limit switch, sealed gear case and magnetic reversing starter. The valve-operating mechanisms shall be as manufactured by Limitorque Corporation, E.I.M. Company, Inc., or Engineer approved equal.

The valve shall have a worm gear assembly completely enclosed in a watertight case with a disc position indicator.

The valve operating mechanism shall permit motor or manual turning of the disc from 0 to 90 degrees. The time required to turn the disc 90 degrees with the motor shall be not less than 30 seconds nor more than 60 seconds unless otherwise specified. A handwheel with an arrow and either the word "open" or "close" thereon shall be provided for manual operation. The handwheel shall not rotate during motor operation. A hand lever shall be provided to mechanically disconnect the motor drive from the gear train for manual operation. The valve operating mechanism shall automatically return to motor operation when the motor is energized. The valve operating mechanism gear case shall be totally sealed and factory packed with extreme pressure type heavy duty lubricants. The maximum torque required to operate the handwheel for manual operation shall not exceed 60 ft-lbs, and the maximum tangential force required on the handwheel rim to operate shall not exceed 60 pounds.

A geared limit switch shall be provided to govern the disc travel from the fully open to the fully closed positions. The geared limit switch shall be adjustable and shall stop the disc at precisely the open and closed position settings. The limit switch settings shall not be affected by temperature changes. The geared limit switch shall be geared to the operating mechanism of the disc and shall be synchronized with the disc position whether the disc is operated by the motor or manually.

A torque limit switch shall be provided and shall disconnect the motor energy in the event of mechanical overload. The torque limit switch shall be adjustable and shall function without auxiliary relays or devices.

The geared limit switch and the torque limit switch within the valve operation mechanism shall be electrically isolated and shall be located in a NEMA IV case which allows for adjustment.

The motor shall be 120-volt, 1-phase, 60 Hertz totally enclosed, non-ventilated, high starting torque, with low starting current for starting under a full load across the line. The motor shall have Class B insulation and shall have a motor frame with all dimensions in accordance with the latest revised NEMA Standards. All motor bearings shall be the ball bearing type. Thrust bearings shall withstand all radial loading.

A magnetic reversing starter shall be furnished and installed on the valve in a NEMA IV housing. The starter shall operate on 120-volt, 1-phase, 60-Hertz electrical power. The opening and closing coil of the starter shall operate with 120-volt, 1-phase, 60-Hertz electrical power. Selector switches, lights and push buttons shall be installed in the starter housing with a local lockable lockout. Wiring diagrams shall be furnished in accordance with Document No. 1005 of these specifications.

4. Installation:

Valves shall be installed at the locations and in the orientation indicated on the Plans unless otherwise noted. Buried valves shall incorporate thrust blocks and valve boxes.

Valve boxes shall be concrete with cast iron lids. The boxes shall be provided with schedule 40 “purple” PVC extension sleeves. Valve boxes and covers shall be similar in all respects to Christy #G5 traffic valve box with C275 lid, Brooks 4TT, or approved equal.

All valves shall be operated by Contractor prior to and following installation to assure free movement, proper seating, and full-port opening.

Contractor shall lubricate the seat of all rubber-seated valves prior to installation with 111 Silicone Compound as manufactured by Dow Corning, G 661 Silicone Compound as manufactured by General Electric, or Engineer approved equal.

Contractor shall install and test all valves furnished in conformance with the drawings and specifications.

Contractor shall supply to Engineer records of tests performed on valves or component parts thereof that are required by the AWWA Valve Standard specified in these specifications, if requested by Engineer any time within a period of one (1) year after the acceptance of the work.

Shop drawings shall be furnished in accordance with Document No. 1001 of these specifications. Shop drawings shall be submitted with the valve operator in the position and orientation as shown on the drawings.

5. Protective Coatings:

Valves shall be provided with a shop-applied fusion-bonded epoxy coating on interior and exterior surfaces in a minimum thickness of ten (10) mils. Match color of adjacent piping or as shown on the plans.

Any damage to the protective coating including scratches, nicks, etc. shall be repaired prior to the installation using an approved coating conforming to AWWA C209 and C214 and shall be completed to the satisfaction of Engineer or his approved representative.

All exposed steel on buried valves, fittings, etc. such as nuts and bolts shall be coated with an approved tar or mastic prior to installation and conforming to AWWA C209 and C214.

6. Fittings:

All fittings shall conform to AWWA C110 and have a cement-mortar or epoxy fusion coating and lining conforming to AWWA C104. All fittings may be gray (cast) iron or ductile iron with a minimum pressure rating of 250 psi. Unless otherwise indicated on the Plans, fittings may be either push-on (ring-tite), mechanical joint, or flanged.

7. Valve Identification:

All buried valves located outside the pavement structure shall be identified with the appropriate Carsonite Utility Marker (CUM-375), five feet - two inches (5'-2") with the appropriate decal or approved equal. Marker shall be installed no more than 5 feet from the valve measured perpendicular to the new main or roadway.

END OF DOCUMENT 2011

Document No. 2012 FIRE HYDRANTS (12/31/00)

1. Scope:

The work to be done under this section consists of furnishing all plant, labor, equipment, materials, supplies and incidentals and performing all work required for furnishing and installing the fire hydrant assemblies, complete.

2. Trench Excavation and Backfill:

Trench excavation and backfill shall conform to the requirements as specified in Document No. 2001 Staking, Excavation, Backfilling and Compacting for Water Lines of these Technical Specifications.

3. Pipe:

The water pipe to be installed from the water main to the fire hydrant shall be the same type of pipe utilized for construction of the water system improvements.

4. Valves and Valve Boxes:

Valve and valve boxes for fire hydrants shall conform to the requirements as specified in Document No. 2009 Gate Valves of these Technical Specifications.

5. References:

References herein are made to the standards, tests, methods, and specifications of research and technical organizations as follows:

ITEM	**STANDARD SPECIFICATION, TEST OR METHOD DESIGNATION**
Fire Hydrants	AWWA C502-73

6. Materials:

Fire hydrant shall conform to the requirements of Section 307 of the Standard Specifications and this section of these Technical Specifications.

<u>All hydrants shall be as follows:</u>

The size of a valve opening shall be five and one quarter inch (5-1/4") with two (2) two and one half inch (2-1/2") N.S.T. (National Standard Thread) nozzles; one four and one half inch (4-1/2") NST nozzle which shall meet Carson City's thread specifications. The inlet connections shall be a six inch (6") size and the operating nut one and one and one half inch (1-1/2") pentagon, open to the left.

Fire hydrants shall be of the compression type with the valve closing with the pressure. All hydrants shall be in accordance with the latest specifications of the American Water Works Association. All parts entering into the manufacture will be interchangeable. All fire hydrants shall be non-freezing and self-draining.

The top of the hydrant shall be constructed so that the operating threads are immersed in an oil reservoir. The oil reservoir shall be sealed at both top and bottom by "0" rings to prevent oil or water leakage. The bonnet assembly shall be unitized and flanged to the tip barrel for easy removal as one unit without disassembly or loss of lubricant in the field. The main valve opening shall be controlled with a positive stop built into the bonnet assembly. The hydrant shall be of the safety ground flange design at a point two inches (2") above ground line. In the event of a traffic accident, the barrel will not become broken, nor the main operating stem become broken or bent, which parts shall be easily and quickly replaced. The safety

flange design shall be constructed to ensure more accurate control of impact stresses and eliminate the uncertainties of frangible bolt and lug designs such as corrosive and varying bolt strength. The drain valves shall be bronzed to bronzed seat with quadring and shall be positively operated by main operating nut. The design shall permit full three hundred and sixty (360) degree rotation in any desired position location & placement of the hydrant shall be in accordance with all Fire Department regulations. Hydrants shall be constructed for lengthening or making repairs without the necessity of digging. Hydrant barrel shall be centrifugally cast ductile iron.

Hydrants shall be subjected, after assembly to two (2) tests under a hydraulic pressure of 300 pounds per square inch. One (1) test shall be made with the whole interior of the hydrant under pressure; and another with the main valve closed and the footpiece under pressure from the inlet side. Under the above test procedure, there shall be no leakage through the main valve, drain valve, or stuffing box, nor through the castings or the joints of the assembled hydrant. Leakage or other imperfections found in either test shall be corrected before the hydrant is accepted. The test is not required for any existing fire hydrants.

Fire hydrants shall be the five and one quarter inch (5-1/4") WB67 DDP type, as manufactured by the Waterous Company, or approved equal by the Carson City Fire District Fire Chief and Engineer. HYDRANTS SHALL BE PAINTED FIRE HYDRANT ORANGE IN ACCORDANCE WITH FIRE DISTRICT STANDARDS.

7. Workmanship:

Fire Hydrant installation shall conform to the requirements of Subsection 307.09, "Setting Hydrants", of the Standard Specifications for Public Words Construction.

Contractor shall notice, coordinate and cooperate with the Fire Department before any shut-down of a fire hydrant of water line is to be made. Contractor shall keep the Fire Department fully informed on any emergency repairs being made which affect the water distribution system.

All buried metallic materials of the fire hydrant assemblies shall be encased in polyethylene (plastic wrap) in accordance with the requirements of AWWA C105.77.

Before the fire hydrant assembly is backfilled, Contractor shall contact the inspector for an inspection review using the Carson City Public Works Department "Inspection for Fire Hydrants" form. The inspection shall be performed in the presents of Contractor and the inspector. Also included in the inspection will be a check of the street valve to assure full open position.

END OF DOCUMENT 2012

Document No. 2013 THRUST BLOCKS (5/10/01)

1. General:

Thrust blocks shall be installed in the locations shown on the Drawings and in general, everywhere a buried pressure conduit changes direction according to Carson City "Standard Details for Public Works Construction".

2. Materials:

Concrete used for thrust blocks shall have a minimum compressive strength of 4000 psi at twenty-eight (28) calendar days when tested in accordance with ASTM C39 and shall contain not less than 6.0 sacks of cement per cubic yard of concrete.

3. Installation:

Thrust blocks shall be installed such that they bear against the pipe fitting (not the pipe) on one side and against undisturbed earth on the other side.

Thrust block concrete shall not obstruct removal of flange bolts from fittings. Concrete shall be prevented from adhering to the fittings. Either a liquid bond breaker shall be applied to the fitting, or an impervious membrane (plastic, building paper, etc.) shall be used.

The bearing area against the undisturbed soil shall be measured in a vertical plane, perpendicular to the axis of the pipe, or the line bisecting the extensions of the pipes entering a fitting. The bearing area shall be as set forth in the thrust block table in the Drawings.

END OF DOCUMENT 2013

Document No. 2014 COUPLINGS, DISMANTLING, AND EXPANSION JOINTS (5/10/05)

1. General:

Couplings, dismantling and expansions joints shall be installed in the locations and conform to the sizes shown on the Drawings.

2. Materials:

2.1 Bolted Couplings:

Bolted couplings shall have malleable iron followers, steel sleeves, high strength bolts with hexagon nuts and wedge-type resilient material gaskets. Bolted couplings shall be designed for a working pressure of 150 psi and shall be as manufactured by Romac Series 501, or equal. Coupling restraints shall be installed in the locations as shown on and detailed in the Drawings.

2.2 Flanged Coupling Adapters:

Flanged coupling adapters shall have high grade gray iron or steel bodies with malleable or ductile iron followers with high strength bolts and wedge-type resilient material coupling gaskets and "O-ring" flange gaskets. Flange coupling adapters shall be designed for a working pressure of 150 psi and shall be as manufactured by Romac Series FCA501, or equal.

2.3 Restrained Couplings:

When noted on the Drawings, bolted couplings or flanged coupling adapters shall be restrained with couplings equipped with anchor boss and anchor bolts. These couplings shall be installed in strict conformance to the Drawings and manufacturer's recommendations. Restrained couplings for PVC pipe shall restrain by contacting the circumference of the pipe. Restraining devices which point load PVC pipe, in the opinion of Construction Manager, shall not be considered or allowed.

2.4 Expansion Joints:

Expansion joints shall be installed where indicated on the Drawings. Expansion joints shall have a neoprene cover and a teflon tube and be equipped with thrust control rods. Expansion joints shall be Holz Series 980 molded expansion joints or equal.

2.5 Dismantling Joints:

Dismantling joints shall have high grade gray iron or steel bodies with malleable or ductile iron followers with high strength bolts and wedge-type resilient material coupling gaskets and “O-ring” flange gaskets. Dismantling joints shall be as manufactured by Romac Series DJ 400, or approved equal.

3. Installation:

Couplings, dismantling and expansion joints shall be installed in accordance with the manufacturer's recommendations. All buried couplings shall be wrapped with two (2) layers of ten (10) mil polyethylene film and sealed with ten (10) mil plastic tape.

END OF DOCUMENT 2014

Document No. 2015 WATER MAIN HYDROSTATIC TESTING (4/17/02)

1. General:

This specification supersedes Section 336.03.08, “Pressure Line - Pressure and Leakage Tests”, of the Standard Specifications. Water mains shall be pressure tested in accordance with all the following requirements.

2. Test Pressure:

Test pressure for water distribution pipe shall be the class designation/rating of the pipe.

3. Procedure:

Pressure and leakage tests shall be performed at the same time. The total testing time for each section of a new main installed shall be a minimum of two (2) hours.

When pipeline installation, testing and backfilling can be accomplished in the same day, backfill only enough to prevent lifting of the pipe prior to filling with water and field testing. When conditions require that trenches be backfilled immediately after the pipe has been laid, testing shall be conducted prior to placement of permanent surface.

After the main has been laid it shall be filled with water for a minimum of twenty-four (24) hours before being subjected to the hydrostatic pressure test. Each section of pipeline shall be filled slowly with water and all air expelled by means of taps at points of highest elevation.

The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to Engineer. The test pressure shall be maintained for the specified time during which all exposed pipe, couplings, fittings, valves, and hydrants shall be examined carefully.

All cracked or defective elements shall be removed and replaced and the test repeated until all visible leakage has been stopped and the requirements as specified in subsection Allowable Leakage have been met.

4. Allowable Leakage:

No pipe installation will be accepted if the leakage for the section of the line that is tested is greater than that determined by the following formula:

Allowable Leakage (gallons per hour) = $ND(P)^{1/2}/7400$	
Where:	N = Number of pipe joints in test section. D = Nominal diameter of pipe (inches). P = Test pressure (psig).

If the test leakage in any section is greater than permitted, Contractor shall, at his own expense, locate and repair the defective materials until the leakage is within the permitted allowance. All visible leaks shall be repaired regardless of the amount or rate of leakage.

5. Measurement of Leakage:

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within five (5) psi (0.35 Bar) of the specified test pressure

after the air in the pipeline has been expelled and the pipe filled with water. The quantity of water supplied to maintain pressure shall be quantified by means of a positive displacement measurement from a reservoir of known volume. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

END OF DOCUMENT 2015

Document No. 2016 WATER MAIN DISINFECTING (4/30/01)

1. General:

Disinfection of water mains shall be accomplished in accordance with all the requirements set forth in AWWA C651-92 unless otherwise specified herein.

Precautions shall be taken to protect pipe interiors, fittings, and valves against contamination. Pipe delivered for construction shall be stored so as to minimize entrance of foreign material. When pipe laying is not in progress, for example, at the close of the day's work, all openings in the pipeline shall be closed by water tight plugs. Joints of all pipe in the trench shall be completed before work is stopped. If water accumulates in the trench, the plugs shall remain in place until the trench is dry.

If dirt, that in the opinion of Engineer, will not be removed by flushing enters the pipe, the interior of the pipe shall be cleaned and swabbed as necessary with a 5% hypochlorite disinfecting solution.

No contaminated material capable of supporting prolific growth of micro-organisms shall be used for sealing joints. Packing material shall be handled in such a manner as to avoid contamination.

Yarning or packing material shall consist of molded or tubular rubber rings or treated paper. Materials such as jute or hemp shall not be used.

The lubricant used in the installation of sealing gaskets shall be suitable for use in potable water. It shall be delivered to the job in enclosed containers and shall be kept clean.

2. Procedure:

2.1 General:

Unless otherwise stated herein, the tablet method of disinfection shall be used. However, since this method requires scrupulous cleanliness to be effective, it will not be allowed if trench water or foreign material has entered the main. If the pipe, in Engineer's opinion is not in a clean condition another method prescribed in AWWA C651-92 shall be used for disinfection even if the tablets have already been installed.

2.2 Placement of Tablets:

Tablets shall be placed in each section of pipe and also in hydrants, hydrant branches, and other appurtenances. They shall be attached by an adhesive, except for the tablets placed in hydrants and in the joints between the pipe sections. All the tablets within the main must be at the top of the main. If the tablets are fastened before the pipe section is placed in the trench, their position shall be marked on the section to assure that there will be no rotation.

The adhesive may be Permatex No. 1 or any alternative approved by Engineer. There shall be no adhesive on the tablet except on the broad side next to the surface to which the tablet is attached.

2.3 Filling and Contact:

When installation has been completed, the main shall be filled with water at a velocity of less than one (1) foot per second. This water shall remain in the pipe for at least twenty-four (24) hours. Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

2.4 Dosage:

The number of hypochlorite tablets to be attached to the inside of each section of pipe shall be as shown in the following table taken from AWWA C601-86:

Number of 5-G Hypochlorite Tablets Required for Dose of 25 Mg/l*						
Length of Section-feet	**Diameter of Pipe - inches**					
	4"	**6"**	**8"**	**10"**	**12"**	**16"**
13 or less	1	1	1	2	3	4
18	1	1	2	3	4	6
20	1	1	2	3	4	7
30	1	2	3	4	6	10
40	1	2	4	5	7	13
*Based on 3.25 g Available chlorine per tablet; any portion of tablet rounded to next higher number.						

2.5 Final Flushing:

After the applicable retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is no higher than that generally prevailing in the system, or less than one (1) mg/1. Chlorine residual determination shall be made to ascertain that the heavily chlorinated water has been removed from the pipeline.

2.6 Bacteriologic Tests:

After final flushing and before the water main is placed in service, a sample or samples shall be collected by Contractor from the end of the line and submitted by Contractor to the Carson City Wastewater Reclamation Plant Laboratory for testing for bacteriologic quality and shall show the absence of coliform organisms.

2.7 Repetition of Procedure:

If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained at Contractor's expense. The tablet method cannot be used in these subsequent disinfections. When the samples are satisfactory, the main may be placed in service.

END OF DOCUMENT 2016

Document No. 2017 UNDERGROUND MARKING TAPE (4/17/02)

1. General:

Underground marking tape shall be installed above all buried water pipelines.

2. Materials:

Tape shall be non-detectable polyethylene marking tape. Tape shall be blue in color and shall be three (3) inches wide by 4 mil thick and shall bear large printing denoting, "Buried Water Line Below".

Tracer wire shall be 12 gauge coated solid copper wire taped every 5 (five) feet to all water mains, water services, air releases etc. and shall remain continuous and conductive throughout all components of the water system. All splices, as from a service wire to a main wire, shall be soldered and wrapped with UL listed electrical tape.

3. Installation:

Underground marking tape shall be installed according to the manufacturer's instructions and as shown on the Drawings.

Marking tape shall be continuous from valve to valve. Tape shall be placed flat with the writing facing up and shall be laid twelve (12) inches above the top of pipe between the bedding and the trench backfill.

END OF DOCUMENT 2017

Document No. 2018 ALTITUDE VALVES (6/19/02)

1. General:

This section specifies the altitude valve to be used for the project.

2. MATERIALS:

Valves shall be constructed of the following materials:

Item	**Material**
Body	Cast Iron ASTM A48
Trim	Bronze ASTM B61, Brass QQ-B-26
Pilot Control System	Bronze with stainless Trim

3. Type:

The valve shall be the two-way flow type which closes at the high water level, and opens for the return flow when the pressure at the valve inlet is less than the storage reservoir pressure. Valve shall be a non-throttling type which will remain full open until the shutoff point in the reservoir is reached.

This valve shall be a hydraulically operated, diaphragm-actuated, globe pattern valve. It shall contain a resilient, synthetic rubber disc, having a rectangular cross-section, contained on three and one-half sides by a disc retainer and forming a tight seal against a single removable seat insert. The diaphragm assembly containing the valve stem shall be fully guided at both ends by a bearing in the valve cover and an integral bearing in the valve seat. This diaphragm assembly shall be the only moving part and shall form a sealed chamber in the upper portion of the valve, separating operating pressure from line pressure. The diaphragm shall consist of nylon fabric bonded with synthetic rubber and shall not be used as a seating surface. Packing glands and/or stuffing boxes are not permitted and there shall be no pistons operating the valve or pilot controls. All necessary repairs shall be possible without removing valve from the line.

The pilot control system shall be a diaphragm-actuated, three (3)-way type that operates on the differential force between the height of the water in the reservoir and an adjustable spring-load.

The entire valve and control system shall be designed so that no surface water can be drawn into the pilot system or main valve at any time. Valve shall be flanged and shall have a pressure rating of 175 psi. The altitude valve shall be Cla-Val Clayton Model 21OG-16, with spring range 5-100 feet of water. In order to maintain system uniformity, no substitutes will be accepted.

4. Installation:

Valves shall be installed in accordance with the manufacturer's recommendations. Contractor shall be responsible for placing and adjusting the different levels of the mercury pots for the initial setting of the tank shut off level.

END OF DOCUMENT 2018

Document No. 2019 AIR RELEASE, AND AIR AND VACUUM VALVES (10/13/03)

1. General:

Air release, and air and vacuum valves shall be installed in the locations and shall conform to the types and sizes shown on the Plans.

2. Materials:

Air and vacuum valves shall be designed to allow large quantities of air to escape out the orifice when filling a pipeline and to close water tight when the liquid enters the valve. The air and vacuum valve shall also permit large quantities of air to enter through the orifice when the pipeline is being drained to break the vacuum. The valve shall consist of a body, cover, baffle, float and seat. The baffle will be designed to protect the float from direct contact of the rushing air and water to prevent the float from closing prematurely in the valve. The seat shall be fastened into the valve cover without distortion and shall be easily removed if necessary. The float shall be stainless steel designed to withstand 300 psi or more. The float shall be center guided for positive seating.

Air release valves shall be designed to release accumulated air from a pipe while the pipe is in operation and under pressure. Resilient seats shall be replaceable and provide drop tight shut-off to the full valve operating pressure rating of 150 psi.

The bolts and nipples of the valve must be tar coated for resistance to corrosion. Air release valves shall be "Valmatic" or “APCO” brand valves, or approved equal. Air and vacuum valves shall be “APCO” brand, or approved equal.

3. Installation:

Air release, and air and vacuum valves shall be installed in accordance with the manufacturer's recommendations.

END OF DOCUMENT 2019

Document No. 2020 PRESSURE REGULATING VALVES (12/31/00)

1. General:

This section applies to the installation of pressure regulating valves. Pressure regulating valves shall be installed in the locations as shown on the Plans.

2. Materials:

Valves shall be constructed of the following materials:

ITEM	MATERIAL
Body	Cast Iron
Main Valve trim	Brass, Bronze, Stainless Steel
Pilot Control	Cast, Bronze, Stainless Steel

Description of Basic Pressure Reducing Valve and Optional Features:

1) Globe Type

2) Restriction Tube Fitting

3) CRD Pressure Reducing Control

4) CDC/CSC Check Valve

5) CK2 Shutoff Cock

6) Flow Clean Strainer

7) CV2 Stabilizer Reducing Low Flow Fluctuations

8) CV Flow Control Regulating Closing Speed of the Valve

3. Design:

Valves shall automatically reduce a higher inlet pressure to a steady downstream pressure regardless of flow rates. They shall prevent return flows from reverse pressures. They shall be single or double seated hydraulically operated with pilot controlled diaphragm. They shall be a globe type valve, and the operation shall be completely automatic. Valves shall have adjusting screws with a jam nut and cover on the pilot control. Valves shall comply with ASTM A48, ASTM B61, and ASTM B62 and have a temperature range to a + 180 degree F. max.

4. Installation:

Pressure regulating valves shall be installed as per Plans and Drawings. All valves shall be tested by Contractor prior to installation.

5. Steel Pipe:

All fittings shall conform to AWWA C110. Welded steel pipe shall be permitted within the vault and extending no more than two (2) feet on either end. All steel welded or flanged pipe shall be coated and wrapped to AWWA Specification, C203, C204, C205, C209, C210, C602, or some combination of these coatings.

END OF DOCUMENT 2020

Document No. 2021 STEEL PIPE (3/11/05)

1. General:

Steel piping shall include all steel pipe, fittings, specials, and closure pieces. The pipe diameters shown on the drawings or specified in this division of this specification are nominal inside diameters. Pipe 12 inches in diameter or less may be furnished in ASA Schedule 40 or heavier steel pipe.

The manufacturer of pipe shall furnish an Affidavit of Compliance to Engineer stating that all pipe, specials, fittings, lining and coating, and all materials furnished to the work comply with these specifications and the AWWA standards.

Shop drawings for all steel pipe, fittings, specials, and closure pieces 8 inches in diameter and larger shall be submitted as specified in subsection 7.4 Shop Drawings and Quality Control/Inspections of the General Conditions. Each section of the steel pipe, fittings, specials, and closure pieces shall be assigned a "mark number" which shall be referenced on the shop drawings and stenciled on the inside wall and the outside wall of each pipe or special section. In fabricating specials, a mark corresponding to the true vertical axis of the fitting shall be made on the top and bottom of the specials.

2. Products:

2.1 Materials:

All steel used in the fabrication of steel piping and steel plate specials shall be in accordance with the provisions of this section.

Materials used in fabricating the steel cylinders shall be hot-rolled carbon steel sheets or plates. Steel sheets shall conform to the “Specification for Hot-Rolled Carbon Steel Sheets and Strip, Structural Quality,” ASTM A 570, Grade 33. Plates shall conform to the “Specification for Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality,” ASTM A 283, Grade D or the “Specification for Structural Steel,” ASTM A 36, except as modified herein. The minimum yield point of steel used for fabrication of steel cylinders shall be 33,000 psi.

Steel used in welded steel plate specials shall conform to the requirements of Subsection 2.1 A(1). Dimensions of steel plate specials shall conform to the “Standard for Dimensions for Fabricated Steel Water Pipe Fittings,” AWWA C208.

Steel used for wire reinforcement shall conform to the requirements of the “Specifications for Cold Drawn Steel Wire for Concrete Reinforcement,” ASTM A 82, or the “Specification for Welded Steel Wire Fabric for Concrete Reinforcement,” ASTM A 185.

Unless otherwise shown on the Contract Drawings, all steel pipe shall be fusion bonded epoxy lined and coated (FBE) and shall conform to the requirements of the “Standard for Steel Water Pipe 6 Inches and Larger,” AWWA C200, and the “Standard for Fusion-bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines,” AWWA C213, except as modified herein.

Except as otherwise provided herein, the steel cylinder for FBE steel pipe shall have a minimum wall thickness as follows:

Design Pressure (psi)	**Nominal Pipe I.D. (Inches)**	**Steel Cylinder O.D. (Inches)**	**Minimum Wall Thickness (Inches)**
200	10	10.750	0.375
200	12	12.750	0.375

Pipe and appurtenances shall be designed for maximum deflection of 2 percent under external loads.

Steel plate specials are defined as bends, reducers, outlets, closure pieces, piping in structures, or other special shapes. Steel plate specials shall be dimensioned in accordance with the “Standard for Dimensions for Fabricated Steel Water Pipe Fittings,” AWWA C208, and shall be manufactured in accordance with the “Standard for Steel Water Pipe 6 Inches and Larger,” AWWA C200, and the “Standard for Fusion-bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines,” AWWA C213.

Except as otherwise provided herein, steel plate specials shall be fabricated from steel plate. The finish inside diameter of the steel plate specials shall match the finish inside diameter of the FBE lined and coated steel pipe specified above and have a wall thickness as follows:

Design Pressure (psi)	**Nominal Pipe I.D. (Inches)**	**Steel Cylinder O.D. (Inches)**	**Minimum Wall Thickness (Inches)**
200	10	10.750	0.375
200	12	12.750	0.375

Pipe flanges and gaskets shall conform to the requirements of the “Standard for Steel Pipe Flanges for Waterworks Service – Sizes 4 In. through 144 In.” AWWA C207. All flange installation shall be done in the shop and shop coated with FBE after welding. No field welding shall be accepted.

Fusion-Bonded Epoxy lining and coating shall conform to the requirements of the “Standard for Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines,” AWWA C213. All FBE coating shall be applied in the shop.

3. Installation:

3.1 Outlets:

Outlets permitted by these Contract documents shall be built into the wall of the pipe and shall be formed by welding to the cylinder, cast or fabricated steel fittings of suitable design before the exterior FBE coating is placed around the fittings. Outlets 12 inches and smaller may, at the option of Contractor, be fabricated from Schedule 40 or heavier steel pipe in the standard outside diameters, i.e., 12¾, 10¾, 8⅝, 6⅝, or 4½ inches. All outlets shall be designed in accordance with the Manual of Water Supply Practices, “Steel Pipe - A Guide for Design and Installation,” AWWA Manual No. M11. Unless otherwise shown on the drawings or specified herein, outlets with diameters less than or equal to 66.67 percent of the principal pipe diameter shall be reinforced with collar pads. Outlets with diameters from 66.67 to 83.33 percent of the principal pipe diameter shall be reinforced with wrapper plates, and outlets with diameters greater than 83.33 percent of the principal pipe diameter shall be reinforced with crotch plates. Wrapper plates may be used in lieu of crotch plates if supporting calculations are submitted as a part of the original shop drawing. The measurement from the outside of the principal pipe to the face of the flange shall be 9 inches unless otherwise shown on the drawings.

Except as otherwise shown on the drawings, where bends are specified, the radius of bends shall not be less than 2½ times the pipe diameter or ten feet, whichever is less. At the option of Contractor, a bend may be factory welded to the adjacent pipe section.

Except as otherwise shown on the drawings, the length of all reducers shall not be less than seven times the difference in the pipe diameters to be connected.

3.2 Fabrication and Testing:

The pipe shall be manufactured in sections having nominal lengths of 20 to 48 feet except where shorter lengths are required on curves, at major street intersections, where closure or special sections are required, or where otherwise shown on the drawings. The pipe shall consist of a welded steel cylinder with steel flanges. Each end of each pipe section shall be provided with wood stulls of suitable size wedged into position at right angles to each other, using at least one wedge at each end to prevent the pipe from becoming out-of-round prior to installation. Spacing of the stulls shall be in accordance with Section 3.3(a). Additional bracing shall be used to limit the deflection in any pipe section to not more than ½ of 1 percent of the pipe diameter and shall remain in place until the sections of the pipe are joined together and backfilled. The pipe shall be furnished complete with rubber gaskets, butt straps, and closure pieces where required.

Steel cylinders may be fabricated by using one or more steel sheets for each cylinder. All welding shall be by an approved method that shall produce a full penetration of the weld in accordance with the “Standard for Steel Water Pipe 6 Inches and Larger,” AWWA C200, Section 3.2.1. Welds may be either straight or spiral. The welds when tested shall develop the tensile strength of the adjoining sheets. After each cylinder has been completed with joint rings welded in place, but before lining and coating, it shall be tested under hydrostatic pressure in accordance with the “Standard for Steel Water Pipe 6 Inches and Larger,” AWWA C200, Section 3.4. The cylinder shall show no leaks, undue distortion, or other defects. Any leaks shall be re-welded by hand and the pipe tested again. No caulking to stop leaks will be permitted. After pipe with welded bells has been hydrostatically tested, the longitudinal welds in the bell shall be tested by an etching test in accordance with the “Standard for Steel Water Pipe 6 Inches and Larger,” AWWA C200, Section 3.3.5.4.

Each steel plate special, upon completion of the welding, but before lining and coating, shall be bulkheaded and tested under a hydrostatic pressure of not less than 1½ times the design pipe pressure, provided, however, that if straight pipe used in fabricating the specials has been previously tested, no further hydrostatic testing will be required, provided the transverse seams are tested by the herein stated etching test process. Any pin holes or porous welds that may be revealed by the test shall be chipped out and re-welded and the pipe or fittings retested.

On finished pipe, the circumference of the inside bell ring contact surface shall not exceed the circumference of the outside spigot ring contact surface by more than 3/16 of an inch. Bell and spigot joints shall conform in all respects to details shown on the drawings. Where welded joints are specified, the pipe shall be provided with slip-bell joints or butt-strap joints for field welding. If butt-strap joints are to be provided and field cutting will not be required, the butt-strap sections shall be attached to the ends of the pipe at the manufacturer's plant. Half of each butt-strap shall be welded to the upper half of the pipe, and the remaining half of the butt-strap shall be welded to the lower half of the adjoining pipe. Field and plant welding shall be as shown on the drawings. Butt-straps shall be accurately aligned and retained in position during welding to ensure proper alignment of the pipe upon installation. Welded joints shall conform in all respects to the details shown on the drawings.

Steel plate specials shall be fabricated in accordance with the following provisions in addition to those provisions specified herein above:

1) All hand welding shall be done by welders certified in accordance with Appendix II of the “American Standard Code for Pressure Piping,” ASA B 31.1, or in accordance with the “Standard for Field Welding of Steel Water Pipe,” AWWA C206.

2) Where mechanical type couplings are shown, the ends of the pipe shall be supplied with Type D shoulders as shown in Figure 2 of AWWA C606. Where pipe smaller than 12 inches is furnished in standard diameters and where the wall thickness equals or exceeds the manufacturer's minimum recommended wall thickness, the pipe ends may be grooved. Where sleeve type couplings are shown, the ends of the pipe shall be supplied in accordance with AWWA C219.

3) Except as otherwise specified or shown on the drawings, all flanges to be installed on pipe or fittings shall be faced and drilled in accordance with 150 pound ASA dimensions or, in lieu thereof, and shall be in accordance with the “Standard for Steel Pipe Flanges for Waterworks Service,” AWWA C 207,

Class D or Class E as applicable. All flanges shall be furnished with flat faces. All pipe flanges shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise shown on the drawings. Attachment of the flanges to the pipe shall conform to the applicable requirements of the “Standard for Steel Pipe Flanges for Waterworks Service,” AWWA C207.

Steel pipe and fittings to be installed in structures shall have the exterior surfaces thoroughly cleaned and coated with an epoxy system in accordance with the requirements of “Standard for Fusion-bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines,” AWWA C213. Where painting of exterior is desired for color coding, painting shall be as specified in Document No. 7001 Painting of these Technical Specifications in addition to FBE coating in accordance with these specifications. Unless otherwise shown on the drawings, exterior surfaces of pipe or fittings passing through structure walls shall be coated to a point approximately 6 inches inside the structure or the wall flange if provided.

3.3 Handling and Transporting Steel Pipe:

All handling and lifting of pipe and pipe specials shall be done with belt slings. A minimum of two slings shall be used at approximately the 1/3 points of each pipe section. The slings shall bear uniformly against the pipe. Padded cables may not be used as slings. No metal shall bear against the pipe during handling. When not being handled, pipe shall be supported on timber cradles, sand bags, or mounds of earth properly prepared to eliminate all rock points and provide uniform support along the full length. Factory wood stull bracing shall be installed between seven and nine feet from each pipe end and at a maximum interval of ten feet throughout the entire length of the pipe section with a minimum of four stulls installed per 40 foot pipe section. Wood stulls shall remain in place until backfill operations are complete. When being transported, the pipe shall be supported at all times in a manner that will not permit distortion or damage to the lining or coating with all strapping and tie-downs being located within two feet of the wood stull bracing. Any pipe that is damaged as a result of handling or transporting shall be repaired to the satisfaction of Engineer or shall be removed and replaced as directed by Engineer.

All pipe shall be transported using blocking and hold-downs during shipment to prevent movement or shifting.

3.4 Installation of Steel Pipe:

Unless otherwise specified or shown on the drawings, Contractor shall furnish and install all pipe, specials, fittings, closure pieces, thrust blocks, valves, supports, bolts, nuts, gaskets, jointing materials, and all other appurtenances as shown on the drawings and required to provide a complete installation. Pipe supports shall conform to pipe details where shown on the drawings provided that the support for all exposed piping shall be complete and adequate regardless of whether or not supporting devices are specifically shown on the drawings. At all times when the work of installing pipe is not in progress, all openings into the pipe and the ends of the pipe in trenches or structures shall be kept tightly closed. Contractor shall maintain the inside of the pipe free from foreign materials and in a clean and sanitary condition until its acceptance by Engineer. The pipe sections shall be laid in the trench to true alignment and grade in accordance with the drawings. Exceptional care shall be exercised in placing the pipe. Bumping of the pipe in the trench will not be permitted. Where closure sections are required by Contractor's laying operations, the sections shall be installed in accordance with applicable sections of these specifications. Contractor shall take all necessary precautions to prevent the pipe from floating due to water entering the trench from any source, assume full responsibility for any damage due to this cause, and at his own expense restore and replace the pipe to its specified condition and grade if it is displaced due to floating.

When the pipe is laid, the trenches shall be in a reasonably dry condition, and all necessary facilities shall be provided for lowering and properly placing the pipe sections in the trench without damage. All handling of steel piping shall be as specified in subsection Handling and Transporting Steel Pipe. The slings shall bear uniformly against the pipe. When not being handled, all pipe shall be supported on timber cradles, sand bags, or mounds of earth. Wood stull bracing shall remain in place until backfill operations are complete. The pipe sections shall be laid to the line and grade shown on the drawings, and they shall be

closely jointed to form a smooth flow line. Immediately before placing each section of pipe in final position for joining, the bedding for the pipe shall be checked for firmness and uniformity of grade.

Contractor shall take care during the backfill operation not to overload the pipe and cause excessive deflection in the pipe. After the backfill operation is completed, the interior of the pipeline will be inspected for excessive deflection caused during the backfill operations. If any section of pipe is determined to have defected greater than two percent of the inside diameter of the steel cylinder, Contractor shall remove and replace that pipe section. Re-rounding of the pipe in place may be considered on a case-by-case basis. The pipe has been designed to withstand a live load equivalent to AASHTO HS-20. Backfilling and compaction equipment shall not be used over the pipe which exceeds this live load limits.

Rubber gasket joints shall be made by properly lubricating the rubber gasket with a suitable vegetable compound soap before it is placed in the groove at the spigot end. The gasket shall be stretched over the spigot end of the pipe and carefully seated in the groove. The gasket shall not be twisted, rolled, cut, crimped, or otherwise damaged or forced out of position during the closure of the joint. A “feeler” gage shall be used to check the position of the rubber gasket after the bell and spigot ends of the pipe joints have been joined together. Contractor shall coordinate the performance of the “feeler” gage check with the Inspector to allow for the observation of these checks.

3.5 Non-Fusion Bonded Epoxy Steel Pipe:

All Non-FBE steel pipe shall meet the same structural, testing and installation requirements as FBE steel pipe and be installed in accordance with the manufacturers instructions.

Field welding is permitted on non-FBE pipe and shall be done in accordance with AWWA C206. All welds shall be performed by certified welders and shall be sound, free from embedded scale and slag, have a tensile strength across the weld of not less than that of the thinner of the connected sections. All welds shall be water tight. The exterior of all direct buried non-FBE pipe shall be wrapped with cold applied tape in accordance with AWWA C209. Connections made between FBE pipe and plain steel pipe shall be done with flexible coupling adaptors as described in these specifications.

END OF DOCUMENT 2021

Document No. 3001 STAKING, EXCAVATION, BACKFILLING AND COMPACTING FOR SEWER LINES (7/5/07)

1. General:

Before any excavation on the project, Contractor shall notify all local utility companies and "Call Before You Dig" at 1-800-227-2600. Excavation shall include the removal of all materials or obstructions of any nature, the installation and removal of all sheeting and bracing and the control of water necessary to construct the work as shown. Excavation work shall be performed in a safe and proper manner with suitable precautions taken against hazards of every kind. Sheeting and shoring shall conform to the requirements of OSHA and Section 305.06 of the Standard Specifications. There is a significant likelihood that groundwater will be encountered during structure excavation. Contractor shall be prepared to install and maintain pumping equipment necessary to control groundwater during construction.

Pumping to maintain sewer service will be required. Contractor shall have on site, sufficient sized pumps and length of hose to accomplish this task. Contractor shall have a back up pump available at all times. Contractor shall be responsible for all cleanup, fines or other ramifications resulting from a spill.

Back fill during freezing weather shall not be done except by permission of Construction Manager or his representative. No backfill material shall be installed on frozen surfaces, nor shall frozen materials, snow or ice be placed in any backfill.

2. Reference Specifications and Standards:

Relative compaction or density, when hereinafter referred to, means the in-place dry density of the soil expressed as a percentage of the maximum dry density of the same soil as determined by the ASTM D1557 test procedure. The costs of site compaction or density testing shall be paid for by Carson City. The costs of all retests (from failed tests) shall be paid for by Contractor.

3. Staking Out the Work:

Contractor shall retain a Nevada Licensed Professional Land Surveyor, and the Surveyor or his Subordinates shall stake out the horizontal and vertical positions of all the Work. Contractor shall satisfy himself as to the accuracy of all measurements before constructing any permanent structure and shall not take advantage of any errors found on the Drawings. Where new construction connects to existing facilities, Contractor shall pothole and establish the exact locations and elevations prior to construction of the facilities.

Construction surveying, at a minimum, should include the location and depth for manholes, and intermediate stakes for line and grade of the sewer lines. It shall be Contractors responsibility to expose the existing sewer lines at the points of connection for the new lines and to maintain the depths of cover and slopes as indicated on the Drawings. It will also be Contractor's responsibility to pothole existing utilities and, after approval by Construction Manager, modify the grade as required to match or avoid existing utilities while maintaining the general slope of the pipe.

4. Trench Work:

4.1 Trench Configuration and Alignment:

Trenches shall be excavated to provide for the bedding as specified in subsection Bedding.

The new pipeline shall be laid essentially as per the alignments and grades shown on the Drawings.

Trenches and other excavations shall have the minimum width which Contractor can effectively excavate and install the improvements. Excessive widths will not be permitted. Trenches shall have a minimum width of twenty four (24) inches greater than the outside diameter of the pipe to be installed. Deviations from this recommended width must be submitted to Construction Manager in writing for approval. The

bottom of the trench shall be graded uniformly to provide a continuous bedding support under the pipe, and to allow the pipe to be laid to the grades and alignments shown in the Drawings.

5. Pipe Bedding:

The trench shall be over excavated to a depth of at least six (6) inches below the bottom of the pipe and backfilled to the required grade of the bottom of the pipe with bedding material. The pipe bedding shall be brought to optimum moisture content and compacted to not less than 90% relative density. The pipe bedding at the trench bottom shall have a flat or semicircular cross section. The bottom of the trench for all pipe shall be graded and prepared to provide a firm and uniform bearing surface throughout the entire length of each pipe section except for excavation required at joints. Pipe couplings shall not rest on the trench bottom and laying the pipe on mounds will not be allowed.

5.1 Bedding Through the Pipe Zone:

After center loading the pipe to prevent lateral movement, select granular material free from stones, clods, or other deleterious material shall be placed in the trench simultaneously on each side of the pipe for the full width of the trench in layers not to exceed eight (8) inches in depth. Each layer or lift shall be compacted to at least 90% of maximum density, evenly, on each side of the pipe throughout the pipe zone. The pipe zone is to extend from bottom of the pipe to twelve (12) inches above the top of the pipe and shall be backfilled with bedding material as specified herein.

5.2 Backfill Above the Pipe Zone:

From twelve (12) inches above the top of pipe to the top of the trench, if not in existing pavement, or bottom of the pavement structure, if in existing pavement, pipe backfill shall consist of material as specified in subsection Backfill. No oil cake, bituminous pavement, concrete, rock or other lumpy material shall be used in the backfill. Backfill material shall be compacted to not less than 90% relative density. All trenches shall be backfilled after pipe fittings and appurtenances have been installed, inspected and approved. All trash, wood, large rocks, waste material and other objectionable debris shall be removed from the excavation prior to any material being placed in the trench.

Where existing underground pipes or conduits larger than three (3) inches in diameter cross the trench above the new work, the backfill from the bottom of the trench to the spring line of the intersecting pipe or conduit shall be Crushed Gravel Base material, Type 2, Class B, Aggregate Base conforming to the requirements of Section 200.01.03 of the Standard Specifications, compacted to 90% of relative density. The aggregate base material shall extend two (2) feet on either side of the intersecting pipe or conduit which will insure that the material will remain in place while other backfill is placed.

Backfill by jetting shall not be allowed. Backfill shall be densified by mechanical compaction.

6. Site Excavation:

The bottom of the excavation shall not be more than one-tenth (0.10) foot above or below the lines and grades specified. If the elevation of structure excavation is not specified the excavation shall be not more than one-tenth (0.10) foot above or below the elevation specified for fill material below the structure. Cut slopes shall vary no more than five-tenths (0.5) foot from specified grade unless the excavation is in rock where the maximum variation may be two (2) feet. Unless otherwise specified, excavations shall extend a sufficient distance from walls and footings to allow for placing and removal of forms, installation of services, and for inspection, except where concrete is specified to be placed directly against excavated surfaces. Upon completion of excavation, the existing subgrade shall be compacted to a minimum of 90% relative density.

Should the excavation be carried below the lines and grades specified on the Drawings, or should the bottom of the excavation be disturbed because of Contractor's operations and require over-excavation and backfill, Contractor shall refill such excavated space to the proper elevation in accordance with the procedure specified for backfill.

6 Rock Excavation and Blasting:

No blasting will be permitted without the approval of Construction Manager. When blasting is permitted, it shall be done only by skilled operators and under the direction of a competent, properly licensed foreman.

Blasting will be permitted only when proper precautions are taken for the protection of persons, the work, and existing structures. Any damage done to persons, private property, the work, or existing structures shall be the responsibility of Contractor.

Blasting shall be done with explosives of such power and in such quantities and positions as not to make the excavation unduly large, or to shatter the faces of cuts which are to remain open. Excessive blasting or "overshooting" will not be permitted, and any material outside the authorized cross-section which may be shattered or loosened by blasting shall be removed and replaced with earth as herein specified, at Contractor's expense. Construction Manager shall have authority to require Contractor to discontinue any method of blasting which leads to "overshooting" or is dangerous to the public or destructive to property or to natural features.

6.1 Permits for blasting shall be obtained and paid for by Contractor.

7. Sheeting and Shoring:

Excavation for trenches shall be properly and substantially sheeted, braced, and shored as required by trench conditions. Sheeting, bracing, and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure and shall be rigid, maintaining shape and position under all circumstances. Contractor’s design for all sheeting and shoring shall be signed and sealed by a licensed Nevada Civil or Structural Engineer and the drawings submitted to Construction Manager prior to its construction.

During backfilling, any shoring shall be carefully removed by Contractor in such a manner as will result in a minimum of caving, lateral movement, or flowing of the soil. On approval of Construction Manager, Contractor may leave shoring in place, but in such an event, no payment will be made by Carson City for such materials left in place. Where trench shoring is left in place, it shall not be braced against the pipe.

8. Materials:

8.1 Bedding:

Pipe bedding material shall conform to the requirements of Section 200.03.02, Class A Backfill, of the Standard Specifications, except as noted on the drawings.

Bedding shall be placed in accordance with Section 305.08, Bedding, of the Standard Specifications.

8.2 Backfill:

Trench backfill shall conform to the requirements of Section 200.03.06, Class E Backfill, of the Standard Specifications, unless otherwise specified.

Trench backfill shall be placed and compacted in accordance with Section 305, Trench Excavation and Backfill, of the Standard Specifications.

Backfill for any structure shall be Crushed Gravel Base material, Type 2, Class B, Aggregate Base conforming to the requirements of Section 200.01.03 of the Standard Specifications.

If site excavated material meets the requirements for Class “E” Backfill but exceeds optimum moisture content, Contractor shall take whatever measures are necessary to dry the material to a compactable moisture content. No additional compensation shall be allowed for such measures. If site excavated

material does not meet "Class E Backfill" requirements in accordance with the Standard Specifications, Contractor may be directed by Construction Manager to remove and dispose of the unsuitable material to an approved disposal location and import acceptable material.

8.3 Pavement Structure:

Defined as that section from the top of the backfill to the road wearing surface. This section shall consist of Crushed Gravel Base material, Type 2, Class B, Aggregate Base conforming to the requirements of Section 200.01.03 of the Standard Specifications, compacted to 95% relative density overlaid with asphalt concrete at a depth to match the contiguous pavement, but not less than that specified for roadway sections. Refer to the Permanent Pavement Patch Detail on the Drawings and, if applicable, also refer to the Patching Details for Work within NDOT Right-of Way.

8.4 Construction:

Maximum Length of Open Trench:

Except by permission of Construction Manager, the maximum length of open trench where prefabricated pipe is used, shall be five hundred (500) feet, or the distance necessary to accommodate the amount of pipe installed in a single day, whichever is the greater.

8.5 Control of Water:

When water is encountered, Contractor shall furnish, install, maintain and operate all necessary machinery, appliances, and equipment to keep excavations free from water until the placing of the bedding material, laying and jointing of the pipe, pouring of concrete, and placing of the backfill material has been completed, inspected, and approved and all danger of flotation and other damages is removed. Groundwater pumped from the trench shall be disposed of in such a manner as will not cause injury to public or private property, or constitute a nuisance or menace to the public, and shall be subject to the prior approval of Construction Manager and all regulatory requirements of the State of Nevada. If well points are used for dewatering, they shall be removed or abandoned according to State of Nevada regulations.

8.6 Special Foundation Treatment:

Whenever the bottom of the trench is soft, yielding, or in the opinion of Construction Manager otherwise unsuitable as a foundation for the pipe, the unsuitable material shall be removed to a depth approved by Construction Manager and replaced with suitable material approved by Construction Manager. Payment of this work will be made only if the bottom of the trench has become unstable due to circumstances beyond the control of Contractor. Payment for this work will be made as specified in subsection Modification Procedures of the General Conditions, unless otherwise provided for in these Contract documents.

8.7 Restoration of Roadway Surfaces:

All road shoulders and pavement which are broken or damaged due to Contractor's operations shall be reconstructed by Contractor at no additional cost to Carson City. Reconstruction shall be subject to the approval of Construction Manager.

Repairs Required by Trench Settlement:

If, at any time during a one (1) year period from the date of final acceptance of the project, there is any settlement of the trenches requiring repairs to be made, or should any other defect appear in the system due to negligence or carelessness on the part of Contractor, Carson City will notify Contractor to immediately make such repairs as may be deemed necessary at Contractor's expense.

9. Surplus Material:

All surplus material shall be disposed of off site in accordance with applicable ordinances and environmental requirements. Contractor shall be responsible for ultimate disposal of surplus material.

END OF DOCUMENT 3001

Document No. 3002 SEWER MAINS, SERVICES & APPURTENANCES (4/14/03)

1. Scope:

The work to be done under this section consists of furnishing labor, equipment, materials and incidentals and performing all work necessary for furnishing and installing sewer mains, manholes, pump stations, force mains and laterals.

Trench excavation and backfill shall conform to the requirements as specified in Document No. 3001 Staking, Excavation, Backfilling, and Compacting for Sewer Lines of these Technical Specifications.

2. Materials:

2.1 Gravity Sewer Pipe:

Gravity Sewer Pipe shall be PVC SDR 35 pipe as specified in Section 203.15 of the Standard Specifications, unless otherwise noted on the drawings.

2.2 Pipe Fitting:

2.2.1 Gravity Wyes and Bends:

All fittings, wyes and bends shall be manufactured for the brand and type of pipe supplied. The joints shall be Neoprene or rubber-gasketed bell and spigot or with couplings to match pipe specifications.

All lateral connections shall enter the sewer main on a 45° angle in the center of the top quadrant. Laterals are <u>not</u> to drop straight in from the top of main.

2.3 Manholes:

Manholes shall be precast, unless otherwise approved by Construction Manager, and as specified in Section 204 of the Standard Specifications, except as indicated on drawings. An approved water stop shall be placed on all PVC pipe entering the manhole.

3. Workmanship:

3.1 Pipe:

The sewer pipe shall be installed according to Section 306 of the Standard Specifications. Variance from established line and grade shall not be greater than five hundredths of a foot from grade and not more than five hundredths of a foot from alignment, and shall always maintain the slope as specified on the drawings. Following the completion of the installation, the pipe shall be balled, flushed, and mandreled.

Contractor shall be required to use a pipe laser while installing the pipe for grade and alignment control.

3.2 Manholes:

Bases shall be constructed to maintain invert flow slopes with minimum thickness of concrete under inverts and pipe entry into manhole as indicated on drawing details. Sections and extensions shall be laid straight and true with rim level. The joints shall be sealed with a double layer of an approved plastic or mastic material to exclude all groundwater. After setting each section, push with weight, such as backhoe bucket, with wood blocking to prevent damage, to set joint firmly to prevent future settling. After installation and before backfilling, fill/coat the upper interior 24-inch section joints/cracks as indicated on drawing details with an approved non-shrink grout. All manhole joints so grouted shall be at no additional cost to Carson City.

3.3 Sewer Line Tests:

3.4 Air Testing:

The following provisions supercede Section 336.03.07.04, “Air Pressure Tests”, and Section 336.03.07.04.1, “Test Requirements”, of the Standard specifications.

3.5 Amount of Testing:

Contractor shall air test all the sewer lines after backfilling and settling of the trenches and shall furnish all equipment and personnel required to perform the tests. In addition to the air test of pipe, Contractor shall vacuum test all of the manholes. Any manhole which doesn't pass shall be repaired and retested until satisfactory.

To facilitate the detection of any leaks that may have occurred during the pipe laying operation, Contractor may, as his option, air test any or all of the sewer lines prior to backfilling. However, this test will be in addition to the required air or hydrostatic test following the backfilling and settling of the trench.

3.6 Leakage Allowance:

The leakage allowance requirements of the air test shall be considered satisfied for the section of pipeline being tested if the time required for the pressure to decrease from 3.5 pounds per square inch (psi) to 2.5 psi is greater than 30 minutes between manholes.

3.7 Testing Procedure:

The low pressure air test is a test which determines the rate at which air under pressure leaves an isolated section of pipeline. This rate indicates the presence or absence of pipe damage and/or pipe of poor quality. The test procedure is described as follows: The section of pipe to be tested is plugged at each end. The ends of all branches, laterals, and wyes which are to be included in the test are sealed or plugged. All plugs shall be carefully braced to prevent slippage and blowout due to internal pressure. One of the plugs provided must have an inlet tap or the provision for connecting an air hose.

Connect one end of the air hose to the inlet tap on the plug and connect the other end of the hose to portable air control equipment. The air control equipment can then be connected to a source of air supply such as a portable air compressor.

After the air hoses are properly connected, inject air into the test section. Monitor the air pressure so that the pressure inside the pipe does not exceed five (5) pounds per square inch gauge (psig).

When the pressure inside the test section reaches four (4) psig, throttle the air supply so that the internal pressure is maintained between four (4) and three and five-tenths (3.5) psig for at least two (2) minutes for the temperature of the air to come to equilibrium with the pipe walls.

After the temperature has been allowed to stabilize for the two (2) minute period, the air supply should be disconnected, and the pressure allowed to decrease to three and five-tenths (3.5) psig. At three and five-tenths (3.5) psig, a stop watch is to be started to determine the time required for the pressure to drop to two and five-tenths (2.5) psi.

3.8 Deflection Test:

The following supercedes Section 336.03.09.01, “Deflection Test for Plastic Pipe and Fittings”, of the Standard Specifications:

Installed pipe shall be tested to insure that vertical deflections for plastic pipe do not exceed the maximum allowable deflection. For all pipes 27-inch ID or less, a mandrel shall be pulled through the pipe by hand to ensure that maximum allowable deflections, as shown in the following table, have not be exceeded.

Table 1

Nominal Size (inches)	SDR-35 ASTM Base Inside Diameter (inches)	Allowable Deflection (percent)	Mandrel Size (inches)
8	7.665	5	7.282
10	9.563	5	9.085
12	11.361	5	10.793
15	13.898	4	13.342
18	16.976	4	16.297
21	20.004	4	19.204
24	22.480	4	22.581
27	25.327	4	24.314

Deflection tests shall not be performed until after completion of placement and compaction of backfill. The pipe shall be flushed prior to testing. If the mandrel fails to pass, the pipe will be deemed to be overdeflected. All costs incurred by Contractor attributable to mandrel and deflection testing, including any delays, shall be borne by Contractor at no additional cost.

3.9 The mandrel shall:

1) Have an odd number of legs (9 legs minimum) and be a rigid, nonadjustable mandrel having an effective length not less than its nominal diameter.

2) Be fabricated of steel; be fitted with pulling rings at each end; be stamped or engraved on some segment, other than a runner, indicating the pipe material specification, nominal size, and mandrel OD; and be furnished in a suitable carrying case labeled with the same data as stamped or engraved on the mandrel.

3.10 Television Inspection:

Following completion of the pipe installation, and after the pipe has been balled, flushed, and mandreled, Carson City personnel will television inspect the sewer pipe installation. Contractor shall provide adequate notice to Carson City as to when lines will be ready for television inspection. Any obvious defects in grade, installation, materials, leaks or other problems shall be repaired by Contractor. Contractor shall provide all traffic control for Carson City's inspection.

3.11 Vacuum Testing of Manholes:

The following provisions are added to the Standard Specifications:

336.03.07.05 Vacuum Tests of Manholes. Contractor shall furnish all labor, equipment, and materials necessary to perform a manhole vacuum test. Vacuum test equipment shall be approved by Construction Manager or his representative Inspector. All vacuum tests shall be conducted in the presence of Construction Manager or his representative.

336.03.07.05.01 Test Requirements. Each manhole shall be tested immediately after assembly and prior to backfilling. All lift holes shall be plugged with an approved non-shrink grout. All pipes entering the manhole shall be plugged, taking care to securely brace the plug from being drawn into the manhole. The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendations.

A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed,

the time shall be measured for the vacuum to drop to 9 inches. The manhole shall pass if the time is greater than 60 seconds for 48" diameter, 75 seconds for 60", and 90 seconds for 72" diameter manholes.

If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. Retesting shall proceed until a satisfactory test is obtained.

3.12 Water and Sewer Main Separations:

Water distribution and sewage collection lines must be laid in separate trenches at least 10 feel apart. In well drained dry ground where sewage flow is by gravity at greater than 2 feet per second, water lines may be in the same trench on undisturbed earth 6 feel horizontally and 3 feet vertically above the sewer line.

All water and sewer main crossings shall be protected by using C900-Class 150 pipe for the sewer main a distance of 10 feet on each side of the water main. No joints will be allowed within 10 feet of the water main. An alternate method of concrete encasement for the 10 feet on each side of the water main will also be allowed. (See Carson City Standard Detail, Drawing No. C-9.1 (page 31).

Sewer mains crossing water mains shall be laid to provide a minimum vertical distance of eighteen inches (18") between the outside of the water main and the outside of the sewer main. This shall be the case where the water main is either above or below the sewer. The crossing shall be arranged so that the sewer joints will be equal distanced and as far as possible from the water main joints. Where the water main crossed under a sewer, adequate structural support shall be provided for the sewer to prevent damage to the water main. In crossing areas where there is less than eighteen inches (18") vertical clearance and where C-900 pipe is used a minimum of six inches (6") between outside of sewer pipe and outside of water pipe is required.

END OF DOCUMENT 3002

Document No. 3003 POLYVINYL CHLORIDE PIPE FOR SEWER (12/31/00)

1. General:

This section covers sanitary sewer polyvinyl chloride pipe which shall be furnished and installed complete with all jointing materials, fillings and other appurtenances shown on the Drawings or otherwise required for a complete installation. Contractor shall furnish, install, and test pipe, fittings and appurtenances of the dimensions and types and to the lines and grades shown on the Drawings and specified herein.

1.1 Unloading PVC Pipe:

Prolonged exposure to temperatures near freezing make PVC sensitive to impact and extra care shall be taken in handling PVC during cold weather.

PVC pipe may be off-loaded by hand, either by passing over the side or off the truck end. Sliding one (1) length on another is standard practice in unloading PVC pipe, but lengths in the bottom layer shall be lifted off of the rough surface of the truck body to avoid erosion.

Compact shipping units (palletized bundles in a wood frame) are used to ship large orders of pipe. These units can be unloaded by conventional fork lifts.

2. Materials:

2.1 Description:

This specification covers PVC Solid Wall Pipe to be used for sanitary sewers, storm drains and house connection sewers. Pipe and fittings shall be made from PVC compounds as defined and described in ASTM D-1784 for Rigid Poly (vinyl chloride), Compounds and Chlorinated Poly (vinyl chloride) Compounds. Pipe and fittings shall meet the requirements of ASTM D-3034 PSM (SDR 35). The pipe and materials shall be made of PVC plastic having a cell classification of 1245B or 1245C (with minimum tensile modulus of 500.000 psi), as defined in ASTM D-1784.

2.2 Testing:

Hydrostatic pressure test. A pipe joint constructed of joint compound shall not leak when subjected to an internal hydrostatic pressure of ten (10) pounds per square inch for a period of five (5) minutes.

2.3 Pressure Pipe:

When called for on the Drawings, in the details or in these specifications, PVC pressure pipe shall conform to AWWA C900. Pipe class shall be as shown on the Drawings or as called for in these specifications and have an outside diameter equivalent to cast iron pipe. The standard pipe length shall be 20 feet.

2.4 Identification Marks:

Pipe and couplings shall be clearly and permanently marked with all information required by AWWA C900.

2.5 Testing:

All materials shall be sampled and tested in accordance with all requirements of AWWA C900. Pipe not manufactured in the U.S. shall be tested as required above by an approved testing laboratory within the U.S.

2.6 Affidavit of Compliance:

The manufacturer shall furnish an affidavit of compliance certifying that all tests have been conducted and that the materials comply with the applicable standards and these specifications. Test information shall be

retained and shall be available if required by Engineer.

2.7 Couplings:

Each length of pipe shall be furnished with a coupling consisting of either a PVC sleeve and two (2) sealing rings or an integrally cast bell and one (1) sealing ring designed to hold the pipe in alignment, provide flexibility, separate the ends of the pipe lengths, resist applied earth pressures and provide fluid tightness.

2.8 Rubber Rings:

Rubber rings for joint sealing shall conform to ASTM D1869. All rubber rings shall be stored at a central point and distributed as needed. They shall be kept clean, away from oil, grease, excessive heat, and the electrical motors which produce ozone. If rubber rings are not to be used immediately, they shall be stored in their cartons, as shipped, in a cool, dark place out of the direct rays of the sun.

2.9 Joints:

Joints may be solvent weld where the spigot wedges into a tapered socket and the surfaces fuse together. Solvent cements shall conform to ASTM-D2564 and assembly procedures shall conform to ASTM D-2855. Joints may be elastomeric gasket material providing a water tight seal. Elastomeric gasket joint assembly shall be in accordance with the pipe manufacturer's recommendations. Elastomeric compound shall comply in all respects with the physical requirements specified in ASTM 1869, C-361, or C-443.

3. Installation:

3.1 General:

Installation shall conform to the manufacturer's recommendations except as modified by these specifications and as shown on the drawings.

All laying, jointing and testing for defects and leakage shall be performed in the presence of Engineer and shall be subject to his approval before acceptance. Materials found during construction to have defects will be rejected and Contractor shall promptly remove such defective material from the site.

3.2 Trenching and Backfill:

Requirements for trenching, bedding, and backfill shall be as specified; as required by applicable permits and regulations; and as required by applicable safety codes.

Pipe shall be laid on a shaped trench foundation or shaped bedding as required and with properly dug bell or coupling holes. Supporting pipe on blocks or mounds or earth or bedding material will not be permitted.

3.3 Handling and Stockpiling:

Pipe, fittings and accessories shall be handled in a manner that will insure installation in a sound, undamaged condition. Equipment, tools and methods used in unloading, reloading, hauling and laying pipe and fittings shall be such that the pipe and fittings are not damaged. Hooks inserted in ends of pipe shall have broad, well padded contact surfaces. No unpadded hooks or wire brushes shall be permitted to contact plastic lining. Pipe and fittings in which lining has been broken, split or loosened shall be replaced by and at the expense of Contractor. Where damaged areas are small and readily accessible, Contractor may be permitted to repair the lining in accordance with the manufacturer's instructions. Store pipe on a flat surface so as to support the barrel evenly. Store random lengths separately where they will be readily available. Individual lengths of pipe should be stocked in pipes of no higher than three (3) feet. If pipe is to be stored outside for periods of longer than thirty (30) calendar days, the pipe must be covered to protect it from prolonged exposure to sun's rays. The pipe shall be covered with canvas or another opaque material which shall not be clear plactic sheets. Provisions shall be make for air circulation under the sheet.

3.4 Cutting:

Cutting and matching of pipe shall be accomplished in accordance with the pipe manufacturer's standard recommendations. Pipe shall not be cut with a cold chisel, flame, standard iron pipe cutter, nor any other method that may fracture the pipe, produce ragged, uneven edges or split the pipe end. Cut ends shall be machined smooth to the proper dimensions.

3.5 Pipe Laying:

The pipe shall be laid to the lines and grades shown on the drawings and specified herein and the sections shall be closely jointed to form a smooth flow line. Immediately before placing each section of pipe in final position, the bedding shall be checked for firmness and uniformity of surface. Contractor shall use a pipe laser or beam lazer to assure grade and alignment. Carson City Public Works Department will wave the light test providing a pipe laser is used. Any deviation will be approved prior to construction by Project Engineer.

Proper implements, tools, and facilities as recommended by the pipe manufacturer's standard printed installation instructions shall be provided and used by Contractor for safe and efficient execution of the work. All pipe, fittings, valves, and accessories shall be carefully lowered into the trench by means of derrick, ropes, or other suitable equipment in such a manner as to prevent damage to pipe and fittings. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.

The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective, damaged or unsound pipe shall be repaired or replaced. All foreign matter or dirt shall be removed from the interior of the pipe before lowering into position in the trench. Pipe shall be kept clean during and after laying. All openings on the pipe line shall be closed with watertight expandable type sewer plugs or test plugs at the end of each day's operation or whenever the pipe openings are left unattended. The use of burlap, wood, or other similar temporary plugs will not be permitted.

3.6 Distributing Along the Trench:

Pipe should be strung as near the trench as possible, but, if the trench has not been dug, it shall be kept out of the way of the excavator. It shall be protected from blasting, traffic equipment or other hazards. Where damage as a result of vandalism could occur, only enough pipe for one day's laying shall be strung. The pipe shall be strung so that the bell ends point in the direction that the work is progressing.

3.7 Jointing:

Each pipe joint shall be joined either with a coupling consisting of a PVC sleeve and two (2) rubber gaskets, or an integral bell with one (1) rubber gasket.

The gasket and the gasket seal inside the collar or bell shall be wiped clean before the gasket is inserted. At this time a thin film of lubricant shall be applied to the gasket and to the outside of the clean pipe end. Lubricant other than that furnished with the pipe shall not be used. The end of the pipe shall be then forced into the collar or bell to complete the joint.

The assembly of the joint shall be made in accordance with the printed recommendations of the manufacturer. This shall be accomplished with an assembly tool if so recommended by the manufacturer, so that the resulting position of the sleeve shall be such that is centered over pipe ends. After assembly of the coupling, the rubber gasket location shall be checked with a suitable gauge. Gaskets for the full circumference of the pipe shall be located at a distance from the coupling or bell end as recommended by the manufacturer of the couplings, If the distance does not fall within required limits, the joint shall be disassembled and reassembled in an acceptable manner.

When pipe laying is not in progress, the open end of the pipe shall be closed by approved means to prevent trench water from entering the pipe. Adequate backfill shall be deposited on pipe to prevent

floating of pipe. Any pipe that has floated shall be removed from the trench, cleaned, and relaid in an acceptable manner. No pipe shall be laid when, in the opinion of Engineer, the trench conditions or weather are unsuitable for such work.

3.8 Installation of Fittings:

Fittings shall be installed utilizing standard installation procedures. Fittings shall be lowered into trench by means of rope, cable, chain, or other acceptable means without damage to the fittings. Cable, rope, or other devices used for lowering fitting into trench, shall be attached around exterior of fitting for handling. Under no circumstances shall the cable, rope or other device be attached through the fitting's interior for handling. Fittings shall be carefully connected to pipe or other facility, and joint shall be checked to insure a sound and proper joint.

END OF DOCUMENT 3003

Document No. 3004 UNDERGROUND MARKING TAPE FOR SEWER (4/19/02)

1. General:

Underground marking tape shall be installed above all buried sewer mainlines.

2. Materials:

Tape shall be non-detectable marking tape of premium quality virgin, low density polyethylene, Carsonite International "Non-Detectable Tuff-Tape" or approved equal. Tape shall be three (3) inches wide and four (4) mil or greater in thickness, and shall be green and bear large printing denoting, "Caution Buried Sewer Line Below", or equivalent wording.

3. Installation:

Underground marking tape shall be installed according to the manufacturer's instructions and as shown on the Drawings.

Marking tape shall be continuous from Manhole to Manhole. Breaks in continuity will not be allowed. Any breaks or splices shall be made continuous by a simple knot tying two ends together. Tape shall be laid twelve (12) inches above the top of pipe between the bedding and the trench backfill.

END OF DOCUMENT 3004

Document No. 3005 CONCRETE CUTTING AND/OR CORE DRILLING (9/7/01)

1. Scope:

This section covers the cutting and cbore drilling of existing concrete vaults for tank or manholes water pipe installation.

All concrete shall be cut the full depth so as not to chip outside or inside walls when the cut area is removed.

Steel shall be cut and covered with one (1) inch of grout so as not to puncture the tank or water pipe projecting through the opening.1.3. All openings shall be cut larger than the size of the tank or pipe to be installed, as required by manufacturer for installation of a pipe penetration connector/seal.

A pipe penetration connector/seal, KOR-N-SEAL I & II Wedge Type, or approved equal, shall be installed on all core drilled pipe penetrations of vaults or manholes.

Loading of the wall area above the hole cut for the tank or water pipe shall be prohibited until the pipetank or waterline is set, and the connector/seal is installed.

If an additional section of wall area is removed and repoured, a flexible type material three fourths (3/4) of an inch shall be placed between the tank or pipeline and the poured concrete. This material shall be approved prior to installation by Project Engineer. All cuts shall be sealed water tight on the exterior wall of the vault with plastic mastic before backfilling.

END OF DOCUMENT 3005

Document No. 4001 CONCRETE STRUCTURES (4/21/08)

1. General:

This Technical Specification covers all concrete structures including but not limited to bridges, culverts, headwalls, wingwalls, catch basins, manholes, retaining walls, abutments, piers, footings, foundations and similar structures as shown on the Plans and as specified herein.

All work to be performed shall be per Section 311, “Concrete Structures and Masonry Construction” of the Standard Specifications and these Technical Specifications. Also refer to Document No. 4002 Concrete Formwork and Document No. 4003 Concrete Reinforcement, of these Technical Specifications.

Except where the provisions of these Specifications are more exacting, the work of this section shall comply with all applicable provisions of the latest edition of the appropriate specifications of the American Society for Testing & Materials (ASTM) and the provisions of the American Concrete Institute (ACI).

2. Submittals:

Contractor shall submit a mix design for approval for each class of concrete to be used in the Work at least two (2) weeks prior to anticipated placement or as specified in subsection 7.4 Shop Drawings and Quality Control Inspections of the General Conditions.

3. Designing & Proportioning Concrete:

Concrete mix designs shall be prepared and submitted for approval for all classes of concrete to be used on the Project per Section 337.10, “General Structural Use Portland Cement Concrete” of the Standard Specifications.

If concrete is to be pumped, provide separate mix designs for all classes of concrete to be pumped. Slump tests for pumped concrete shall be taken at truck or pump hopper.

Drying shrinkage shall not exceed the indicated values after a seven (7) day curing time and a twenty-eight (28) day drying time when tested in accordance with ASTM C 157.

Approval of the mix design by Construction Manager does not relieve Contractor from full compliance with the strength, shrinkage and other requirements of these Technical Specifications.

4. Sampling and Testing:

Testing and certification of the component materials shall be the responsibility of Contractor. Testing of the end product as placed in the work shall be the responsibility of Carson City.

Batch plant and field inspection will be performed by a testing laboratory selected and paid for by Carson City.

Sampling and/or testing of the in-place concrete necessitated by reasons of unsatisfactory test results from control cylinders will be performed at the expense of Contractor, unless such testing indicates that the concrete meets the Specifications, in which case Carson City shall pay the expense of the testing.

All sampling and testing of component materials shall be performed in accordance with the following standard methods:

5. Concrete:

Inspection and testing of concrete shall be performed per Section 336, “Inspection and Testing” of the Standard Specifications.

If the average strength of five (5) consecutive tests of standard-cured cylinders falls below required compressive strengths, Construction Manager shall have the right to order a change in the mix proportions for the remaining portions of the structure. If the average strength of the job-cured cylinders falls below the required strength, he may require tests in accordance with ASTM Methods of Securing, Preparing and Testing Specimens from Hardened Concrete for Compressive and Flexural Strengths (ASTM C 42), or under load tests to be made of the portions of the structure so affected.

Drying shrinkage tests will be made as directed by Construction Manager. Test specimens shall be taken in the field during construction as directed by Construction Manager to determine compliance with these Specifications. Drying shrinkage specimens shall be fabricated, cured, dried and measured as specified in ASTM Specifications C 157. Measurements shall be made and reported for seven (7), fourteen (14), twenty-one (21), and twenty-eight (28) calendar days of drying. The effective gauge length of the specimens shall be a minimum of ten (10) inches. Longer gauge lengths are acceptable. Specimen size shall be four inches by four inches (4" x 4"). Compression test specimens shall be taken in each case from the same concrete as used for preparing drying shrinkage specimens. These test specimens shall be considered as part of the normal test for the project.

Inspection of Reinforcing Steel and Concrete forms will be required before any concrete may be poured. Contractor shall give Construction Manager a minimum of twenty-four (24) hours advance notice of each concrete pour so arrangements can be made for inspection and testing. The testing laboratory or an authorized representative of Carson City shall be present during the placing of all concrete to monitor the quality and slump of the concrete and the workmanship of placing and finishing. The testing laboratory or authorized representative shall make all necessary slump tests and prepare all required cylinders.

6. Materials:

Materials for Portland Cement Concrete shall be per Section 200.05, “Aggregates for General Structural Use Portland Cement Concrete” and Section 202, “Cement and Related Materials” of the Standard Specifications.

6.1 Admixtures:

Any admixtures used shall conform to the appropriate requirements of ASTM Standards, and shall be approved by Construction Manager before being used. CALCIUM CHLORIDE OR OTHER ACCELERATING ADMIXTURES WILL NOT BE APPROVED UNDER ANY CIRCUMSTANCES.

6.2 Classes of Concrete:

The various concrete mix designs to be used are as follows:

6.3 Class “A” Concrete:

Class “A” concrete shall develop a minimum compressive strength of 3,250 pounds per square inch (psi) in twenty-eight (28) calendar days, combined mix shall weigh approximately 145 pounds per cubic foot (pcf) air dry, coarse aggregate shall be size No. 67 (3/4-inch maximum); 3-inch maximum slump, no admixtures required, maximum shrinkage equal to 0.065%.

6.4 Lightweight Class “LA” Concrete:

Lightweight concrete shall be Class “L.A.” per Section 311.21, “Lightweight Concrete Construction” of the Standard Specifications but shall develop a minimum compressive strength of 3,250 pounds per square inch (psi) in twenty-eight (28) calendar days, with 3 inch maximum slump, coarse aggregate size No. 67 (3/4-inch maximum), maximum shrinkage equal to 0.055%.

6.5 Freeze - Thaw Environment Concrete:

All concrete exposed to freeze-thaw environments shall meet the requirements of Section 337.10.01.01,

"Portland Cement Concrete Exposed to Freeze-Thaw Cycles", of the Standard Specifications.

7. Execution:

7.1 Conduits and Other Embedded Items:

When electrical conduits, pipes or other items are embedded in the concrete, they shall be of such character and so located as not to reduce the strength of the construction. Conduits or pipes less than 3/4-inch in diameter will not be regarded as reducing the strength of the structure. The location of any other item embedded in the concrete shall be verified with Construction Manager.

7.2 Mixing and Placing Concrete:

7.2.1 Preparation of Equipment and Place of Deposit:

Before batching concrete, all equipment for mixing and transporting the concrete shall be cleaned, and all debris and ice shall be removed from the places to be occupied by the concrete. Forms shall be thoroughly wetted (except in freezing weather). The reinforcement shall be thoroughly cleaned of ice, dirt, rust, scale, or other coatings.

Water shall be removed from the place of deposit before concrete is placed. All laitance (green concrete) and other unsound materials shall be removed from hardened concrete before additional concrete is added. Laitance shall be removed by water jet or sand-blasting.

7.3 Mixing:

Ready-mixed concrete shall be mixed and delivered in accordance with Specifications for Ready-Mixed Concrete (ASTM C 94).

7.3.1 Job-mixed concrete will not be permitted under any circumstances.

Mixing equipment shall not be charged beyond its rated capacity; transit mix trucks loaded beyond their rated mixing capacities will not be permitted to discharge.

Plant and equipment for proportioning, mixing and conveying concrete shall be subject to Engineer's approval.

7.4 Conveying:

Equipment for cutting, pumping, pneumatically and conventionally conveying concrete shall be of such size and design as to ensure a practically continuous flow of concrete from the mixer to the place of final deposit without separation or loss of materials.

7.5 Placing:

Placing concrete shall be per Section 311.10, "Handling and Placing Concrete", of the Standard Specification and these Technical Specifications. Concrete shall be deposited in the forms within one hour after the addition of the mixing water. Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. The placing of concrete shall be carried on at such a rate that concrete is at all times plastic and flows readily into the spaces between the bars. No concrete that has been contaminated by foreign material shall be used.

Once placing is started, it shall be carried on as a continuous operation until placement of the panel or section is completed.

All concrete shall be thoroughly compacted by means of approved vibrators during the operation of placing and shall be thoroughly worked around reinforcement, embedded fixtures, and into the corners of the

forms. Vibrators shall be used for consolidation of the concrete only, and care shall be taken to avoid excessive vibration. At least one spare vibrator shall be maintained on the job at all times during the placing of concrete.

Such surfaces as are to be finished shall be brought to proper grade, struck off and finished in a workmanlike manner. In the case of floor slabs, precautions must be taken to be sure that the total thickness shown on the Plans exists at all places. Care shall be taken to avoid excessive "jitter-bugging".

Contractor's superintendent in charge of the concrete work shall mark in ink on the Plans the time and the date of placing of concrete in the different members. These Plans shall be kept on file at the job until the completion of the structure, and shall be subject to the inspection of Construction Manager at all times.

7.6 Finishing of Formed Surfaces:

All finishing of structure concrete shall be per Section 311.14, “Surface Finishes” of the Standard Specifications.

7.6.1 Weather Protection:

7.6.1.1 Cold-Weather Requirements:

Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near-freezing weather. No frozen materials or materials containing snow or ice shall be used.

All reinforcement, forms, fillers and ground with which the concrete is to come in contact shall be free from snow and ice. Whenever the temperature of the surrounding air is below 40 degrees F., all concrete placed in the forms shall have a temperature of 45 degrees F. or higher after placement. Adequate means shall be provided for maintaining this temperature for five (5) calendar days. When high-early strength concrete is used, a temperature of at least 45 degrees F. shall be maintained for three (3) calendar days. In either case, any additional time necessary to ensure proper curing of the concrete shall be provided as directed by Construction Manager. The housing, covering, or other protection used in connection with curing shall remain in place and intact at least twenty-four (24) hours after the artificial heating is discontinued. No dependence shall be placed on salt or other chemicals for the prevention of freezing.

7.6.1.2 Hot Weather Requirements:

In hot weather, suitable precautions shall be taken to avoid drying of the concrete prior to finishing operations. Use of windbreaks, sunshades, fog sprays or other devices shall be provided as needed. Provision shall be made for maintaining concrete in a moist condition by means of mats, kraft paper, or plastic film with all edges sealed for a period of at least five (5) calendar days after placement.

Concrete deposited in hot weather shall not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Concrete temperature shall be less than 75 degrees F., unless higher temperatures are permitted by Construction Manager.

7.7 Structure Backfill:

Structure backfill may not be placed against any structure until the concrete has gained 80% of the design strength, as determined by compressive strength tests.

END OF DOCUMENT 4001

Document 4002 CONCRETE FORMWORK (4/18/08)

1. General:

Formwork for concrete structures shall be per Section 311, “Concrete Structures and Masonry Construction” of the Standard Specifications and these Technical Specifications and as shown on the Plans.

All inserts, anchors, hangers, bolts, pipe sleeves, structural steel shapes, and other imbedded items shown on the Plans shall be installed under this section of the work.

All inserts, anchors hangers, bolts, etc., specified in conjunction with other trades shall be furnished and installed by the trade concerned and under the supervision of this Contractor.

2. Referenced Standards:

Construct and erect concrete formwork in accordance with applicable section of the following referenced standards and applicable construction safety regulations for the place of work:

ACI 318 and 2006 I. B. C. Section 1908 - Modifications to ACI 318.

ACI 318, Section 6.1 - Recommended Practice for Concrete Formwork.

Materials delivered to the job shall be stored and protected so that there will be no inclusion of foreign or undesirable matter and no exposure to any element which would reduce the useful properties of the material.

3. Materials:

Plywood for exposed surfaces shall be Douglas Fir plywood conforming to American Plywood Association requirements for B-B PLYFORM, Class I or II. Alternate equal form material shall be subject to approval by Engineer prior to use.

Lumber for forming foundation and other minor surfaces shall be Douglas Fir or equal.

Nails, spikes, lag bolts, through bolts, anchorages, etc., shall be sized as required to rigidly maintain formwork in place during concrete placement.

Form ties shall be a snap-off metal type designed such that no metal will remain within one and one quarter inch (1-1/4") of the finished concrete surface after ties are snapped.

Form release agent shall be colorless mineral oil or other agent which will not stain concrete or impair natural bonding or color characteristics of finished concrete coating.

Fillets for chamfered corners shall be one (1) inch by one (1) inch rigid foam plastic or clear pine furnished in maximum possible lengths.

4. Execution:

Contractor shall be responsible for the design of all forms and false work supports. The design of all forms shall insure that the various members are not stressed more than allowed by the International Building Code for the materials used.

Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with Plans.

Care shall be taken to insure that forms are true to the required lines, grades, and surfaces so as to give a

uniform, neat and workmanlike finish to all concrete surfaces. Form supports shall be of sufficient strength, properly braced, and on adequate foundations so that there shall be no settlings or distortion when the weight of the concrete is added. Forms for all concrete shall be of such strength and construction as to prevent any spread, shifting, or settling when concrete is deposited therein, and shall be tight enough to avoid any leakage or washing out of cement mortar from the concrete.

Arrange and assemble formwork to permit dismantling and stripping, so that concrete is not damaged during its removal.

Arrange forms to allow stripping without removal of principal shores, where and when these are required to remain in place.

Apply form release agent on formwork in accordance with manufacturer's recommendations. Apply prior to placing reinforcing steel, anchoring devices, and embedded items. Do not apply form release agent where concrete surfaces will receive finishes which are affected by agent. Soak inside surfaces of untreated forms with clean water. Keep surfaces wet prior to placing concrete, except in freezing weather.

Provide formed openings where required for pipes, conduits, sleeves, and other work to be embedded in and passing through concrete members.

Locate and set in place items which will be cast directly into concrete.

Coordinate work of other sections and cooperate with trade involved in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors and other inserts.

Install concrete accessories in accordance with manufacturer's recommendations; straight, level, and plumb. Ensure items are not disturbed during concrete placement.

All exposed concrete corners shall be chamfered three quarter (3/4) inch or tooled unless otherwise shown on the Plans.

When a concrete pour has been stopped for a sufficient length of time so that shrinkage or warp has separated the forms and the concrete, provisions shall be made to draw the forms into firm contact with the concrete before placing additional concrete. Care must be taken to prevent any shoulders or ledges being formed at a cold joint.

Shear keys shall be formed at junctions between floors and walls.

Forms to be reused shall be in good condition and shall be thoroughly cleaned before being used.

5. Tolerances:

The following maximum tolerance shall be allowed for form construction:

Deviation from horizontal and vertical lines respectively:

1/4 inch in 10 feet;

3/8 inch in 20 feet;

Deviation in cross sectional dimensions in thickness of slabs and walls; plus or minus 1/4 inch.

All other; plus or minus 1/2 inch.

Individual form members shall be sufficiently rigid so as to limit deflection between supports to not more than L/360.

6. Cleaning:

Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water drain. Close temporary ports or openings with tight fitting panels flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

Clean forms as erection proceeds to remove foreign matter. Remove cuttings, shavings, and debris within forms. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean out ports.

During cold weather, remove ice and snow from within forms. Do not use de-icing salts. Do not use water to clean out completed forms, unless formwork and concrete construction proceed within heated enclosure. Use compressed air or other means to remove foreign matter.

7. Form Removal:

Do not remove forms, shores, and bracing until concrete has gained sufficient strength to carry its own weight and construction loads which are liable to be imposed upon it. Verify strength of concrete by compressive test results.

Remove formwork progressively and in accordance with code requirements and so that no shock loads or unbalanced loads are imposed on the structure.

Loosen forms carefully. Do not wedge pry bars, hammers, or tools against concrete surfaces.

Remove forms not directly supporting weight of concrete as soon as stripping operations will not damage concrete.

END OF DOCUMENT 4002

Document No. 4003 CONCRETE REINFORCEMENT (5/10/01)

1. General:

Reinforcing steel and its placement in concrete structures shall be per Sections 206, “Reinforcing Steel”, 311, “Concrete Structures and Masonry Construction”, and 326, “Reinforcing and Structural Steel” of the Standard Specifications, these Technical Specifications, and as shown on the Drawings.

All concrete work shown or required is steel reinforced unless specifically shown as "plain concrete." Where reinforcing is not shown on a drawing and the drawing is not marked "plain concrete", then it shall be reinforced the same as other similar work where reinforcing is shown or detailed.

2. Referenced Standards:

Applicable sections of the latest edition of the following referenced standards are incorporated as a part of this specification:

1) ACI 318 - Building Code requirements for Reinforced Concrete.

2) CRSI 63 - Recommended Practice for Placing Reinforcing Bars.

3) CRSI 65 - Recommended Practice for Placing Bar Supports Specifications, and Nomenclature.

4) ASTM A615 - Deformed and Plain Billet Steel Bars for Concrete Reinforcement.

5) ACI 315 - American Concrete Institute - Manual of Standard Practice.

3. Quality Control:

Inspection of Reinforcing Steel: Before any concrete may be placed on any particular portion of the work, the reinforcing steel shall be checked and approved by Engineer or his representative. Any errors or discrepancies found by him shall be corrected before concrete may be placed. Such check and approval shall not relieve Contractor from responsibility for full compliance with contract requirements.

4. Shop Drawings:

Shop drawings of all reinforcing steel shall be submitted to Engineer for approval prior to fabrication. Drawings shall clearly indicate bar sizes, spacings, locations, and quantities, bending, and cutting schedules, and supporting and spacing devices. Submit shop drawings as single copy reproducibles, such as sepia prints.

5. Materials:

Reinforcing steel shall be deformed bars conforming to ASTM A 615, Grade 40. At Contractor's option, Grade 60 may be used in lieu of Grade 40.

All steel for reinforcing shall be new, unrusted stock, free from mill scale and without dirt, rust, or contaminants other than may have accumulated in prompt delivery to the work.

5.1 Accessories Material:

5.1.1 Tie Wire:

Minimum 16-gauge annealed type, or patented system accepted by Engineer.

5.1.2 Chairs, Bolsters, Bar Supports, Spacers:

Sized and shaped for strength and support of reinforcing during construction conditions. Spacer or support bars required for the proper placement of reinforcement shall be provided whether or not shown on the Drawings.

Chairs or bolsters in areas of exposed concrete shall be non-corrosive, and Contractor shall be responsible for selecting a class of chair suitable for the use and finish of the concrete. All bar supports used shall have a minimum protection of Class B.

5.2 Fabrication:

Fabricate concrete reinforcing in accordance with ACI 315.

Locate reinforcing splices, not indicated on Drawings, at points of minimum stress. Location of splices shall be subject to Engineer's approval.

6. Execution:

Reinforcement shall be accurately placed and securely tied at intersections with 16 gauge black annealed wire. It shall be maintained in proper position by chairs, bar supports, or other approved devices. Bars in footings shall be supported on 3" precast blocks.

Bars shall lap not less than 30 bar diameters unless otherwise indicated. Splices in adjoining horizontal bars shall be staggered at least 6 feet.

Where this is not feasible, submit suggestions for Engineer's consideration. Horizontal bars shall be hooked around corners not less than 30 bar diameters.

Concrete protection of reinforcing shall be not less than 1-1/2 inches clear from formed surfaces exposed to air and 2-inches clear where exposed to soil or water, unless otherwise indicated. Reinforcing shall be properly supported to maintain this position during concrete placement.

Wherever conduits, piping, inserts, sleeves etc., interfere with the placing of reinforcing steel as shown or called for, Contractor shall consult with Engineer and secure from him the method of procedure before pouring any concrete. The binding or field cutting of bars around openings or sleeves will not be permitted without Engineer's approval.

END OF DOCUMENT 4003

Document No. 4005 CONCRETE CURB, GUTTER, WALKS, AND DRIVEWAYS (4/11/07)

1. General:

This section includes any sawcutting and concrete removal, forming, pouring, and finishing curb, gutters, walks, and driveways.

2. Reference Specifications and Standards:

Unless otherwise specified herein, all work shall conform to the Standard Specifications.

3. Materials:

All Portland Cement Concrete, unless otherwise indicated, shall have synthetic fiber-reinforcement (at a minimum of 1 lb/CY) with a coarse aggregate gradation conforming to Size No. 67 in Section 200.05.03 of the Standard Specifications, and shall have a 1 to 4 inch slump and 4 to 7 percent entrained air. The minimum 28-day compressive strength shall be 4000 psi. Cement shall be Type II.

4. Subgrade:

The subgrade shall be prepared as specified in Subsection 302.02 of Standard Specifications.

All subgrade shall be compacted to a relative compaction of not less than ninety (90) percent for a minmum depth of six (6) inches, in accordance with test procedures set forth in ASTM D1557-70, Method C.

5. Dimensions:

Unless specified otherewise, the minimum thickness for concrete walks shall be four (4) inches. All other dimensions shall be as shown on the drawings.

6. Drainage Outlets:

Contractor will be required to provide suitable outlets through new curb for all existing building drains along the line of work.

The fully depressed curb opening at driveway entrances shall be one (1) inch above gutter flow line at the curb face. The top of the fully depressed portion of the curb shall be finished to a transverse 3/4 inch slope toward the gutter.

Where walk is to be constructed across driveways to commercial establishments, the thickness thereof shall be six (6) inches, unless otherwise specified on the drawings. At residential driveways, the thickness of the walk will be four (4) inches unless otherwise specified.

7. Forming:

All forming shall be done in accordance with Subsection 312.06 in Standard Specifications.

7.1 Slip Forms:

At the option of Contractor, and with the approval of Engineer, slip form equipment may be used for the construction of curb and gutter. The slip form equipment shall conform to the requirements in Subsection 312.07 in Standard Specifications.

7.2 Placement:

Concrete shall be placed for curb, gutters, walks, and driveways as specified in Subsection 312.08 in

Standard Specifications.

7.3 Joints:

Joints in concrete curb, gutter, and walks shall be designated as expansion joints and weakened plane joints, and shall be constructed as specified by Subsection 312.09 in Standard Specifications.

7.4 Finishing and Curing:

Finish work and curing shall conform to specifications in Subsection 312.10 and 312.11 in Standard Specifications.

7.5 Defective Work:

Any new work found to be defective or damaged prior to its acceptance shall be repaired or replaced by Contractor at no expense to Carson City.

7.6 Removal of Existing Concrete Curb, Walk, Gutters, Cross Gutters, and Driveways:

Concrete shall be removed to neatly sawed edges with saw cuts made to a minimum depth of one and a half (1-1/2) inches. Concrete sidewalk or driveway to be removed shall be neatly sawed in straight lines either parallel to the curb or at right angles to the alignment of the sidewalk. Curb, gutters, sidewalks and driveways shall be removed to the nearest weakened plane joint or, if within four feet (4') of an expansion joint to that expansion joint. No section to be replaced shall be smaller than thirty (30) inches in either length or width. Curb and gutter shall be sawed to a depth of one and one half (1-1/2) inches on a neat line at right angles to the curb face.

All materials removed shall be hauled from the site, at Contractor's expense, to a recognized landfill site approved by Engineer, unless otherwise specified. The construction area shall be left with a neat and finished appearance.

Existing improvements, adjacent property, utilities and other facilities, and trees and plants that are not to be removed shall be protected from injury or damage resulting from Contractor's operations.

8. Backfilling and Cleanup:

Backfilling to the finished surface of the newly constructed improvement must be completed before acceptance of the work.

Upon completion of the work, the surface of the concrete shall be thoroughly cleaned and the site left in a neat and orderly condition.

END OF DOCUMENT 4005

Document No. 4006 PRECAST CONCRETE VAULTS (8/28/01)

1. General:

This section specifies the concrete work and appurtenances required for precast concrete vaults. Vaults shall be constructed of reinforced concrete sections and shall conform to the minimum dimensions shown on the Drawings. Cast-in-place vaults will be considered acceptable only after approval is granted by Engineer. Contractor shall submit to Engineer four (4) sets of shop drawings showing size and placement of reinforcing steel, etc. and structural calculations for the vault design sealed by a licensed Civil Engineer. Vaults shall be designed for a minimum H20-44 traffic loading.

2. Materials:

2.1 Precast Concrete Sections:

Precast sections shall be cast in a yard specializing in precast concrete materials. Contractor shall submit Shop Drawings of the proposed structure for review prior to construction. Drawings must provide information for complete review including dimensions, reinforcement design calculations and layout, etc.

All vaults shall be inspected during casting by an independent, certified testing laboratory, approved by Engineer, to establish the strength of the concrete and the adequacy of curing, to certify the date the vaults were cast, and to confirm that the steel has been properly placed. The cost of these tests shall be included in the various unit price Contract Items and no special payment will be made therefore. This testing shall be performed by the laboratory at Contractor's manufacturing plant, prior to shipment.

At least three (3) cylinders shall be taken each day that vaults are cast, with batch samples to be designated by the laboratory representative. At least one (1) set of cylinders shall be taken for each nine (9) cubic yards of concrete used in the construction of the precast vaults. These samples shall be tested for strength. If the samples fail to meet minimum concrete strength requirements set forth in the Specifications, all vault sections manufactured from the concrete from which the cylinders were made will be considered rejected.

In addition, Carson City reserves the right to core vaults either at the site or point of delivery to validate strength of concrete and placement of steel. If cores fail to demonstrate the required strength or indicate incorrect placement of reinforcing steel, all sections not previously tested will be considered rejected until sufficient additional cores are tested, at Contractor's expense, to substantiate conformance to these requirements.

2.2 Concrete:

All concrete used in the construction of vaults shall have a minimum twenty-eight (28) calendar days compressive strength of 4,000 psi and shall have a mix design prepared per Standard Specifications Section 202.01.08.01, “Concrete Mix Design”.

2.2.1 Curing:

All concrete shall be cured in accordance with any one of the methods specified in ASTM 478. The facilities for curing shall, however, be subject to the review and prior approval of Engineer. No precast concrete shall be delivered to the job site until the specified minimum compressive strength of 4,000 psi, as determined by crushing tests on cured concrete cylinders, has been obtained.

2.2.2 Access Opening:

The access opening shall be installed as shown on the Drawings.

2.2.3 Frames and Covers:

Frames and covers shall be cast of gray iron conforming to ASTM A48 Class 30. Unless specified otherwise, cover shall be of the double leaf opening type, cast in place. Frame shall be securely attached to the top precast shaft unit or section of the vault.

2.2.4 Access Doors & Ladders:

Options for access doors may range from a manhole to a prefabricated style door. Access door and frame for the prefabricated style shall be Bilco Brand, or approved equal, and shall have 1/4-inch steel or aluminum diamond pattern capable of withstanding designed loads as shown on the Drawings. Door shall be equipped with heavy forged brass hinges, stainless steel pins, spring operators for easy operation and an automatic hold open arm with release handle. A snap lock with removable handle shall be provided. Cast in portion of frame shall be coated with bituminous paint prior to casting into concrete. Where double leaf doors are required, a safety chain shall be installed on the doors. A ladder shall be installed as per plan, bolted to vault wall and shall include a “ladder-up” safety post, Bilco Brand or approved equal. Doors shall include a flush mount access panel for a locking hasp and pad-lock assembly. Lid shall be marked by welding 2" letters indicating “WATER” or “RCW” as indicated on the drawings.

2.2.5 Joint Sealing Compound:

Precast sections shall be jointed with a preformed joint sealing compound, "Ram-Nek", manufactured by K. T. Snyder Company, Inc., Houston, Texas, "Quikset" manufactured by Quikset Utility Vaults, Santa Ana, California, or equal, applied in accordance with the manufacturer's instructions.

2.2.6 Waterproofing:

The interior of the vault shall be coated with one coat of gray plus one coat of white water sealant, Latex Base DRYLOK Masonry Waterproofer, or approved equal. The exterior of the vault shall be coated with one coat of fluid-applied elastomeric waterproofing, Vulkem 201 or 222 Waterproofing Membranes, or approved equal. The precast vault does not require an elastomeric sheet at seam locations.

3 Installation:

3.1 Transportation of Delivery:

Every precaution shall be taken to prevent injury to the precast sections during the transportation and unloading of the sections. The precast sections shall be unloaded using skids, pipe hooks, rope slings, or suitable power equipment, if necessary and the sections shall be under perfect control at all times. Under no condition shall the precast sections be dropped, dumped or dragged.

If any precast section is damaged in the process of transportation, or handling, such section shall be rejected and immediately removed from the site and replaced at Contractor's expense.

3.2 Excavation and Backfill:

Excavation and backfill shall be done as specified in Document No. 2001, Staking, Excavation, Backfilling and Compacting for Water Lines of these Technical Specifications. Contractor is to be aware of high ground water conditions which may cause flooding of floating of the vault.

3.3 Joint Sealing Compound:

The sealing compound shall be applied as follows:

1) The joint shall be cleaned with a brush.

2) The Silicon treated protective paper shall be removed from one side of the preformed rope and preformed rope shall be laid paper side up on the cleaned joint surface. The surface shall be pressed firmly end-to-end around the entire joint making one (1) inch laps where necessary.

3) The protective paper shall be removed from the preformed rope and the next section shall be lowered into place.

4) Sufficient preformed joint sealing compound shall be installed so as to completely fill the joint and show a "squeeze-out" on the inside and outside of the joint.

3.4 Pipe and Fittings:

All pipe and fittings, including installation shall conform to the provisions of the Specifications for the designated pipe and fittings.

3.5 Elevation and Installation:

Each section shall be set perfectly plumb. Sections of various heights shall be used in order to bring the top of the vault access opening to the required elevation.

The elevations at which access openings are to be set shall conform to the requirements set forth on the Drawings, but in all cases shall be governed by Engineer in the field. Where the access opening is within the roadway or shoulder, it is to be placed flush with the existing surface. Where the structure is outside the limits of the traveled shoulder, but not in roadside ditch, it should be placed one-tenth (1/10) foot or more above the existing ground surface. Where the access opening falls within the existing roadside ditch or right of way, it is to be placed approximately one and one half (1-1/2) feet above the existing ground surface or as directed by Engineer.

3.6 Concrete Finish:

Concrete walls, roof and floor shall have surface defects repaired and have a minimum rough form finish as specified in the ACI (American Concrete Institute) Manual of Concrete Practice Section 301, Chapter 9 and 10. Interior surfaces of the vault shall be painted with two coats of water resistant acrylic-vinyl white paint as specified in Document No. 7001 Painting of these Technical Specifications. Exterior surfaces of the vault shall be painted, to a depth of six inches (6") below the final grading line as specified in Document No. 7001 Painting of these Technical Specifications, with color to be selected by Carson City.

3.7 Cleaning:

Vaults walls, floor and ceiling shall be cleaned of any foreign debris, including forms, tape, form oil, etc., prior to final acceptance. All vaults shall be thoroughly cleaned of any accumulation of silt, debris, or foreign matter of any kind.

Access openings shall be cleaned of foreign matter to insure a satisfactory fit and appearance prior to final acceptance.

3.8 Testing:

It is the intent of the Drawings and Specifications that vaults be as watertight and free from infiltration as possible. Any evidence of leakage throughout the warranty period shall be repaired to the satisfaction of Engineer at the sole expense of Contractor.

END OF DOCUMENT 4006

Document No. 4008 CONSTRUCTION STANDARDS (5/31/01)

1. Portland Cement Concrete:

1.1 Portland Cement Concrete Compressive Strength Penalty:

The third sentence of Section 202.01.14, Concrete Strength Evaluation, of the Standard Specifications is hereby amended to read: “Concrete in an area represented by the tests shall be considered structurally adequate if the average of the three cores is equal to at least 92.3 percent of the required minimum strength, and no single core is less than 85 percent of the design strength”. In the event any class of Portland cement concrete is placed and is shown by test to be below the specified twenty-eight (28) day compressive strength, a determination shall be made by Engineer as to whether the concrete shall be removed and replaced or allowed to remain in place. This determination shall be based on an evaluation of the durability and other qualities of the concrete necessary to the integrity of the structure. If the concrete is allowed to remain in place, it is agreed by the parties to these Contract documents that a penalty shall be applied to the failing quantity of concrete at a rate of five (5) percent of the Contract unit bid price for each fifty (50) p.s.i. or portion therefore below the specified minimum compressive strength, to a maximum penalty of twenty-five (25) percent, as set forth in the following example for the class of concrete shown:

Specified Min. 28 Day Compressive Strength - p.s.i.	**Penalty (Per Unit Bid Price) Percent Deduction**
3250	0
3,249 – 3,200	5
3,199 – 3,150	10
3,149 – 3,100	15
3,099 – 3,050	20
3,149 – 3,000	25

The reduced price shall apply to all concrete represented by the strength tests below the specified minimum compressive strength.

When a compressive strength test falls below the specified twenty-eight (28) day compressive strength, Engineer may determine that an alternate strength test is required or Contractor may request such a test. When an alternate strength test is required and the test results show the concrete fails to meet the minimum strength required, Contractor shall be responsible for the costs of such alternate strength tests. In case Engineer has not determined that an alternative strength test is necessary and Contractor elects to have an alternate strength test made, Engineer will then make such a test; however, should this test fail to indicate that the twenty-eight (28) day compressive strength requirements have been met, the cost thereof shall be deducted from any money due or to become due to Contractor. Concrete required to be removed will not be paid for and the removal thereof will be made at Contractor's expense.

2. Bituminous Plantmix Pavement:

2.1 Bituminous Material Penalty:

In the event that any bituminous plantmix pavement is placed and is shown by extraction tests to be outside the job-mix formula specifications limits, a determination shall be made by Engineer as to whether the bituminous plantmix pavement shall be removed and replaced or allowed to remain in place. If the bituminous plantmix pavement is allowed to remain in place, it is agreed by the parties to these Contract documents that a penalty shall be applied to the failing quantity of bituminous plantmix pavement as described below.

There shall be a 10 percent deduction per the unit price bid applied to all bituminous plantmix pavement represented by the failing extraction tests for each 0.1%, or portion thereof, out of job-mix formula specification limits as shown below:

Out Of Specification % Range	**Penalty (per Unit Bid Price) Percent Deduction**
0.0% - 0.10%	10%
0.11% - 0.20%	20%
0.21% - 0.30%	30%
0.31% - 0.40%	40%
Greater than 0.40%	Rejected, remove and replace

2.2 Density Penalty:

In the event that any bituminous plantmix pavement is placed and is shown by density tests to be outside the job-mix formula specifications limits, a determination shall be made by Engineer as to whether the bituminous plantmix pavement shall be removed and replaced or allowed to remain in place. If the bituminous plantmix pavement is allowed to remain in place, it is agreed by the parties to these Contract documents that a penalty shall be applied to the failing quantity of bituminous plantmix pavement as described below.

Marshall density (50 blows) Relative Compaction	**Penalty (per unit price bid) Percentage Deduction**
96.0% and above	-0-
95.0% to 95.9 %	10%
94.0% to 94.9%	20%
93.0% to 93.9%	30%
Below 93.0%	Remove and replace

2.3 Thickness Penalty:

In the event that any bituminous plantmix pavement is placed and is shown by thickness tests to be outside the specifications limits, a determination shall be made by Engineer as to whether the bituminous plantmix pavement shall be removed and replaced or allowed to remain in place. If the bituminous plantmix pavement is allowed to remain in place, it is agreed by the parties to these Contract documents that a penalty shall be applied to the failing quantity of bituminous plantmix pavement as described below.

Thickness deficiency In inches	**Penalty (per unit price bid) Percentage Deduction**
0.00" - 0.25"	15%
0.26" - 0.50"	30%
Greater than 0.50"	Remove and replace

Thickness deficiency In inches	**Penalty (per unit price bid) Percentage Deduction**
(NOTE: All thickness measurement shall be done prior to or exclude the thickness of open grade material.)	

END OF DOCUMENT 4008

Document 4010 REMOVAL OF BITUMINOUS SURFACING BY COLD MILLING (3/21/07)

1. General:

The work covered by this specification includes the removal of bituminous surfacing by cold milling, and the cleanup and removal of grindings, all in accordance with these specifications and plans or as established by Engineer.

2. Scope of Work:

Remove bituminous surfacing by the cold milling process using a machine designed to remove, profile and texture the remaining surface of the pavement in one operation. The milling machine shall consist of a rotating powered mandrel drum studded with conical tungsten carbide tipped bits and shall produce a satisfactory reasonable smooth textured surface, and shall be equipped with an effective means for controlling dust and other particulate matter created by the cutting action.

Use a machine capable of accurately establishing profile grades, within plus or minus 0.25 inches, by referencing from the existing pavement or from an independent grade control and having a positive means for controlling cross slope elevations. When referencing from the existing pavement use a 10 feet long, minimum, averaging ski.

The location and depth of removal of bituminous surfacing by the cold milling process shall be as indicated in the plans and Contract Documents.

Increase milling depth at cross streets and curb ramps as directed.

Follow with the removal crew within 250 feet of the milling machine. Broom the milled surface with a motorized pickup brooming device following immediately behind the removal crew.

Make the cuts vertical at longitudinal edges for the full depth of the milling. Clean the entire milled surface of all loose material before applying the tack coat.

END OF DOCUMENT 4010

Document No. 4011 MICRO-SURFACING (2/1/08)

1. General:

This work shall consist of mixing polymer modified asphalt emulsion, aggregate, mineral filler, set-control additives, and water and spreading the mixture on a surface or pavement where shown on the plans, as specified in these special provisions, and as directed by Engineer. The mix should be capable of being spread in variably thick cross-sections (wedges, wheel path depressions, scratch courses and surfaces) which, **after ten (10) minute set time**, curing and initial traffic consolidation, resist deformation throughout the entire design tolerance of bitumen content and variable thickness to be encountered. **The mix shall be capable of being stacked in multiple lifts without bleeding.**

Contractor shall use a crew that has a minimum of one (1) season of experience in placing Micro Surfacing.

2. Material:

2.1 Asphalt Emulstion:

The material for micro surfacing immediately prior to mixing shall conform to the following requirements:

Asphalt emulsion shall be homogenous and shall be a polymer modified quick-setting, quick-traffic cationic asphalt emulsion. The polymer material shall be co-milled with the emulsion solution. The emulsion manufacturer shall certify that the emulsion contains a minimum of 4% polymer solids based on the mass of asphalt (asphalt residual) within the emulsion. Manufacturer shall certify that the asphalt used in the micro-surfacing emulsion is Venezuelan Asphalt, or approved equal before shipping. The emulsified asphalt shall be within ±1% of the design emulsion content.

The CCSIH polymer modified quick-traffic asphalt emulsion shall conform to the following requirements when tested in accordance with the specified test method:

TEST ON EMULSION	TEST METHOD	SPECIFICATIONS
Viscosity, Saybolt Fural at 77ºF. (25C.)	AASHTO T59	16-90 sec.
Storage Stability Test, 24 Hour, %	AASHTO T59	1% Max.
Settlement, % 5 day	AASHTO T59	5% Max.
Distillation	AASHTO T59	3% Max.
Residue	AASHTO T59	64% Min.

TEST ON RESIDUE	TEST METHOD	SPECIFICATIONS
Penetration, 77ºF. (25C.), 100g, 5s	AASHTO T49	60-100 dmm
Ductility, 77ºF. (25C.), 5cm/min.cm	AASHTO T51	60 cm Min.
Softening Point, R & B, Degrees F.	AASHTO T53	140º
Min.Polymer Content % (Solid polymer content based on weight of asphalt)	AASHTO T53	4% Min.
Or Tortional Recovery	CTM 332	20% Min.

2.2 Water:

Water shall be of such quality that the asphalt will not separate from the emulsion before the micro-surfacing is in place on the pavement.

2.3 Additive:

Per the mix design for the micro-surfacing.

2.4 Mineral Filler:

Mineral filler shall be any recognized brand of non-air entrained Portland Cement or hydrated lime that is free of lumps. The type and amount of mineral filler needed shall be determined by the laboratory mix design and will be considered as part of the mineral gradation requirement. An increase or decrease of less than one-percent may be permitted when the micro surfacing is being placed if it is found to be necessary for better consistency or set times.

2.5 Aggregate:

The mineral aggregate used shall be of the type and grade specified for the particular use of the micro surfacing. The aggregate shall be 100% crushed stone such as granite, slag, limestone or other high quality aggregate. The material shall be free from vegetable matter and other deleterious substances. All aggregate shall be free of caked lumps and oversize particles.

SIEVE SIZE	**Type II** **Percent Passing**	**Type III** **Percent Passing**
9.5 mm (3/8')	100	100
4.75 mm (#4)	90-100	70-90
2.36 mm (#8)	65-90	45-70
1.28 mm (#16)	45-70	28-50
600mm (#30)	30-50	19-34
330 mm (#50)	18-30	12-25
150 mm (#100)	10-21	7-18
75 mm (#200)	5-15	5-15

The Type II and/or Type III aggregate shall conform to the following additional quality requirements:

TEST	**TEST METHOD**	**SPECIFICATIONS**
Sand Equivalent	ASTM D2419A	65 Min.
Plasticity	ASTM D4398	Non-plastic
Soundness	ASTM C88	10% Max. using Na_2S0^4 or 15% Max. using M_gSO^4
Abrasion Resistance	ASTM C131	25% Max. at 500 revolutions on gradation D
Durability Index	CAL TEST 229	70 Min.

2.6 Mix Design:

At least seven (7) working days before micro-surfacing placement commences, Contractor shall submit to Engineer for approval a laboratory report of tests and a proposed mix design covering the specific materials to be used on the project.

The tests and mix design shall be performed by a laboratory capable of performing the applicable International Slurry Surfacing Association (ISSA) tests. The proposed micro-surfacing mixture shall conform to the requirements specified when tested in accordance with the following tests:

TEST	ISSA TEST	SPECIFICATIONS
Wet Cohesion 30 minutes (set time) 60 minutes (traffic time)	TB139	 12 kg-cm minimum 20 kg-cm minimum (or near spin)
Excess Asphalt	TB109	538 g/m^2 (50g/ft^2) maximum
Wet Stripping	TB114	Pass (90% minimum)
Wet Track Abrasion One hour soak, loss Six day soak, loss	TB100	 538 g/m^2 (50 g/ft^2) maximum 807 g/m^2 (75 g/ft^2) maximum
Lateral Displacement Specific Gravity After 1,000 cycles@ 56.8 kg (125 lbs.)	TB147A	5% maximum 2.10 maximum
Classification Compatibility	TB144	(AAA, BAA) 11 grade points minimum
Mix Time @ 25ºC. (77ºF.)	TB113	Controllable to 120 seconds minimum

The original laboratory report shall be signed by the laboratory that performed the tests and mix design and shall show the results of the test on individual materials, comparing their values to those required by the specifications. The report shall clearly show the proportions of aggregate, filler, water (minimum and maximum), set control additive, and asphalt solids content (minimum and maximum) based on the dry mass of aggregate. The laboratory shall also report the quantitative effects of moisture content on the unit mass of the aggregate (bulking effect). The mix design will further show recommended changes in cement, water and additive proportions for high temperature weather conditions by reporting proportions of materials required for 60 seconds of mix time.

All the component materials used in the mix design shall be representative of the materials proposed by Contractor to be used on the project.

Once the proportion of materials to be used are approved by Construction Manager, no substitute of other materials will be permitted unless the materials proposed for substitution are first tested and a laboratory report is submitted for the substituted design as specified above. Substituted materials shall not be used until the mix design for those materials is approved by Construction Manager.

2.7 Proportioning:

Aggregate, mineral fillers, asphalt emulsions, water and additives including set-control agent if used, shall be proportioned by volume utilizing the mix design approved by Engineer. If more than one kind of aggregate is used, the correct amount of each kind of aggregate to produce the required grading shall be proportioned separately, prior to adding the other materials of the mixture, in a manner that will result in a uniform and homogenous aggregate blend.

The percentages of each individual material required shall be shown in the laboratory report. Adjustments may be required during the construction, based on field conditions. The component materials shall be within the following limits:

Residual Asphalt	5.5% to 9.5% by dry mass of aggregate
Mineral Filler	0% to 3% by dry mass of aggregate
Additive	As needed
Water	As required to produce proper mix consistency

The completed mixture, after addition of water and any set-control agent, shall be such that the micro-surfacing mixture has proper workability and:

Will permit traffic without pilot car assisted traffic control on the micro-surfacing within one (1) hour after placement.

Will prevent development of bleeding, raveling, separation or other distresses within fifteen (15) calendar days after placing the micro-surfacing.

However, when ambient temperatures are below 25ºC traffic may not be permitted on the micro surfacing until it has sufficiently cured. The time for sufficient curing shall be mutually agreed upon between Contractor and Construction Manager.

Contractor shall furnish an aggregate moisture determination from the stockpile to placing the micro-surfacing and shall be retested if weather conditions have changed the aggregate moisture content appreciably. Aggregate moisture will be accounted for in determining the aggregate/bitumen ratio to be used during placement.

The aggregate shall be proportioned using a belt feeder operated with an adjustable cutoff gate. The height of the gate opening shall be readily determinable. The emulsion shall be proportioned by a positive displacement pump. Any variance rate emulsion pump, if used, shall be calibrated and sealed in its calibrated condition.

The deliver rate of aggregate and emulsion per revolution of the aggregate feeder shall be calibrated at the appropriate gate settings for each mixer-spreader truck used on the project in accordance with California Test 109 and the requirements of these special provisions.

The aggregate belt feeder shall deliver aggregate to the pugmill with such volumetric consistency that the deviation for any individual aggregate delivery rate check-run shall not exceed 2.0% of the mathematical average of three runs of at least three tonnes in duration each. The emulsion pump shall deliver emulsion to the pugmill with such volumetric consistency that the deviation for any individual delivery rate check-run shall be within 2.0% of the mathematical average of three runs of at least 300 gallons each in duration. The water pump shall deliver water to the pugmill with such volumetric consistency that the deviation for any individual delivery rate check-run shall be within 2.0% of the mathematical average of three runs of at least 300 gallons each in duration.

The emulsion storage located immediately before the emulsion pump shall be equipped with a device, which will automatically shut down the power to the emulsion pump and aggregate belt feeder when the emulsion level is lowered sufficiently to expose the pump suction line.

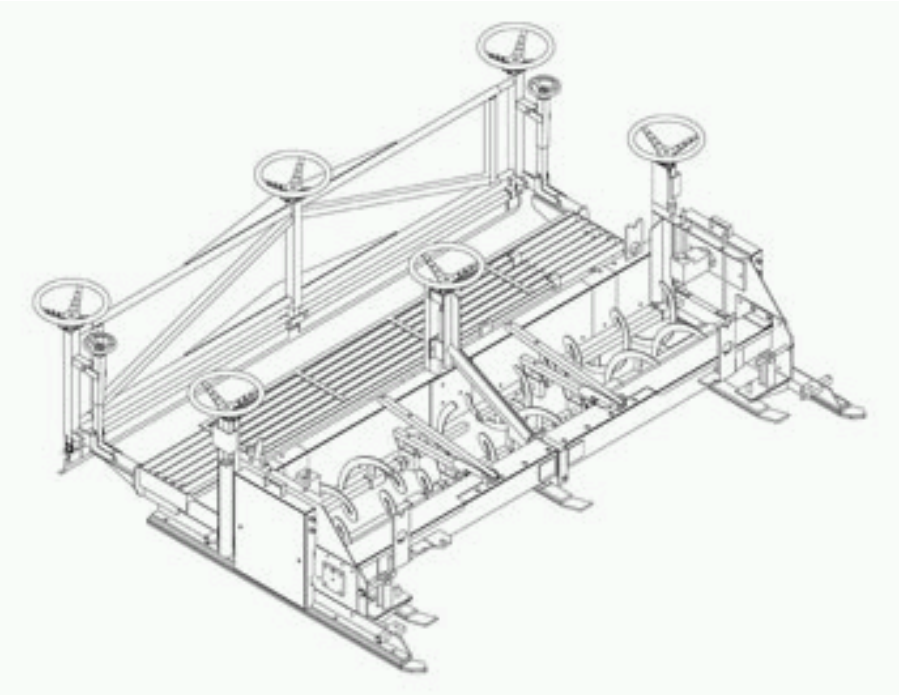
A temperature-indicating device shall be installed in the emulsion storage tank at the pump suction level. The device shall indicate temperature of the emulsion and shall be accurate to within 5ºF.

The maximum temperature of emulsion contained in the mixer-spreader truck emulsion storage tank shall be 120ºF.

The belt delivering the aggregate to the pugmill shall be equipped with a device to monitor the depth of the aggregate being delivered to the pugmill. Said device for monitoring the depth of aggregate shall automatically shut down the power to the aggregate belt feeder whenever the depth of the aggregate is less than the target depth of flow. A second device shall be located where it will monitor movement of the aggregate belt by detecting revolutions of the belt feeder. The device for monitoring no flow or belt movement, as the case may be, shall automatically shut down the power to the aggregate belt when the aggregate belt movement is interrupted. This second device will not be required where the aggregate delivery belt is an integral part of its drive chain. To avoid erroneous shutdown by normal fluctuation, a delay of three seconds between sensing and shutdown of the operation will be permitted.

3. Mixing and Spreading Equipment:

The micro surfacing shall be mixed in continuous twin-shaft pugmill mixers of adequate size and power for the type of micro surfacing to be placed. All indicators required in the section entitled "Proportioning" shall be in working order prior to commencing mixing and spreading operations.



Mixer-spreader trucks shall be equipped to proportion emulsion, water, aggregate, and set-control additives by volume. All rotating and reciprocating equipment on mixer-spreader trucks shall be covered with metal guards.

The mixer-spreader truck shall not be operated unless all low-flow and no-flow devices and revolution counters are in good working condition and functioning and all metal guards are in place. All indicators by these special provisions shall be visible while walking alongside the mixer-spreader truck.

Aggregate feeders shall be connected directly to the drive on the emulsion pump. The drive shaft of the aggregate feeder shall be equipped with a revolution counter reading to the nearest one-tenth of a revolution. The machine shall be equipped with a hydraulically controlled steel pugmill gate for positive discharge and/or shutoff operations. Discharge from the pugmill shall be controlled by a chute or other suitable mechanical device.

The micro-surfacing mixture shall be spread by means of a spreader box conforming to the following requirements:

3.1 Spreader Box:

The spreader box shall have double, reversible, motor driven augers, see figure below, capable of spreading a traffic lane width and shall have strips of flexible rubber belting or similar material on each side of the spreader box and in contact with the pavement to positively prevent loss of micro-surfacing from the ends of the box. All spreader boxes over 7½ feet in application width shall have baffles, double, reversible motor driven augers, or other suitable means, to insure uniform application on super elevated sections and shoulder slopes. Spreader box skids shall be maintained in such a manner as to prevent chatter (wash boarding) in the finished mat.

The spreader box shall have a double strike-off blade design at the rear of the box. The first strike-off blade shall be made of steel or stiff rubber and the second strike-off blade (attached to the first blade) shall be made of a flexible material. Rear flexible strike-off blades shall make close contact with the pavement, and shall be capable of being adjusted to the various crown shapes so as to apply a uniform micro-surfacing coat. A secondary strike-off blade attached to the rear of the spreader box (located behind the double strike-off blades at the rear of the spreader box) shall be provide and shall be adjustable. It shall be designed and operated such that a uniform texture is achieved in the finished surface of the micro surfacing.

Flexible fabric drags attached to the rear of the spreader box shall not be allowed. Strike-off blades (rubber) shall be cleaned or changed daily if problems with cleanliness and longitudinal scouring occur.

3.2 Wheel Path Depression (Rut) Box:

The wheel path depression box shall be designed as a double chambered box with adjustable screens to regulate depth and shall have a width of between 5 feet and 6 feet. Hydraulic augers set at an angle shall move the mixed material from the rear to the front of the filling chamber. The augers shall push the larger aggregate into the center, deeper section of the wheel path depression and send the fine material toward the edges of the pass to act as a mastic and for feathering down the longitudinal joint along the wheel path.

The micro-surfacing spreader box in use shall be clean and free of micro surfacing and emulsion, at the start of each work shift.

Micro-surfacing mixture, to be spread in areas inaccessible to the controlled spreader box, may be spread by other methods approved by Engineer.

3.3 Placing:

The micro-surfacing mixture shall be uniformly spread on the existing surfacing within the rate specified herein.

Micro surfacing shall only be placed when the ambient and pavement surface temperature is (65ºF) minimum and rising. Micro surfacing shall not be placed if rain is falling or is imminent or if there is the possibility that the finished product will freeze within twenty-four (24) hours.

Before placing the micro-surfacing, the pavement surface shall be cleaned by sweeping, flushing or other means necessary to remove all loose particles of paving, all dirt and all other extraneous material.

When wheel path depressions have a cross section that is deformed ½ inch more, the individual wheel paths must first be filled utilizing a wheel path depression box meeting the requirements of these special provisions. Filling of wheel path depressions shall be accomplished using Type III aggregate. Wheel path depression spread rates will vary with depression depth. Maximum single application for wheel path depressions shall be 1½ inches. Greater depths may require multiple applications in each depression.

Wheel path depression repair shall be constructed with a slight crown to permit initial traffic compaction of the micro surfacing.

At least twelve (12) hours of traffic compaction shall be allowed on freshly filled wheel path depressions

before additional lifts are applied as surface courses.

4. Type III Aggregate:

When placing full lane width passes, micro-surfacing mixture shall be spread at a rate within 18 - 35lbs/sy dry weight. The exact application rate will depend upon the grading of aggregate used and the quantity required to result in a flush surface. The completed spread will be within 10% of the rate determined by the mix design.

Longitudinal joints shall correspond with the edges of traffic lanes. Engineer may permit other patterns of longitudinal joints, if such patterns will not adversely affect the quality of the finished product, as determined by Engineer.

Longitudinal joints common to two driving lanes shall be butt joints with overlaps not to exceed 3 inches. Building paper shall be placed at transverse joints, over previously placed micro-surfacing, or other suitable methods, approved by Engineer, used to avoid double placement of micro-surfacing. Hand tools shall be available in order to remove spillage. Ridges or bumps in the finished surface shall not be permitted. No deviations greater then 0.3 of an inch when a 12 foot straight edge is laid across will be accepted.

The mixture shall be uniform and homogeneous after spreading on the surfacing and shall not show separation of the emulsion and aggregate after setting.

Adequate means shall be provided to protect the micro-surfacing from damage by traffic until such time that the mixture had cured sufficiently so that the micro-surfacing will not adhere to and be picked up by the tires of vehicles.

4.1 Test Strip:

Contractor shall construct a test strip to be evaluated by Engineer. The test strip shall be 500 feet to 750 feet long and shall consist of all the application courses specified. The test strip shall be constructed at the same time of day or night that the full production will be applied and may be constructed in two (2) calendar days or nights when multiple course applications are specified. The set time shall be ten (10) minutes. This does not mean the traffic set time is ten (10) minutes.

Engineer will evaluate the completed test strip after twenty-four (24) hours of traffic to determine if the mix design and placement procedure are acceptable. If the mix design or the placement procedure is determined by Construction Manager to be unacceptable the test strip shall be rejected, Contractor shall make modifications and a new test strip shall be constructed. Test strips which have been rejected by Construction Manager shall be paid for by Contractor and shall be considered part of the contract work. If ordered by Construction Manager test strips rejected by Construction Manager shall be removed and shall be at Contractor's expense. Construction Manager will determine how many test strips will be allowed.

4.2 Measurement:

The micro-surfacing shall be measured by square yard.

The quantity of micro-surfacing applied shall be paid for on a per square yard basis, with a penalty for application rates of aggregate or asphaltic emulsion below 90% of their specified rates in the mix design.

4.3 Basis of Payment:

Payment for micro-surfacing shall be in the contract price bid for “Type III Micro Surfacing, complete and in place”.

The accepted quantity of micro surfacing shall be paid for by the Square Yard. The price shall be full compensation for furnishing all materials and for all preparation, mixing and applying these materials, and

for all labor, equipment, mobilization, message boards, traffic control, tools, test design, clean-up and incidentals necessary to complete and warrant the job as specified herein.

Deviations of Aggregate and/or Asphaltic Emulsion from the Rates Specified:

Where amounts of aggregate or asphaltic emulsion are placed in excess of the final mix design, no payment shall be made for such excess. Where amounts of either vary from the rates specified or determined by the final mix design, five cents per square yard ($0.05 /S.Y.) shall be deducted from the Bid Item for each 5% or portion thereof of that either material is below 90% of the rate specified in the mix design.

END OF DOCUMENT 4011

Document No. 6007 ELECTRICAL (6/10/02)

1. General:

The work of this division, where specified or shown on the Drawings or reasonably inferred therefrom, shall include all materials, labor, power, tools, transportation, services and equipment necessary and incidental to the furnishing, installation and completion of the electrical work of this division.

The Electrical Engineer or Construction Manager shall not be responsible for Contractor's failure to carry out the construction work in accordance with the contract documents, nor shall he be required to supervise conduct of the work or the construction procedures and safety procedures followed by Contractor or Subcontractors or their respective employees or by another person at the job site, other than that of the Electrical Engineer's or Construction Manager’s employ.

2. Scope of Work:

The systems to be installed shall consist essentially of the following:

Underground conduit system for primary wiring.

Pre-cast or poured-in-place concrete transformer pads.

Electrical Service equipment and Raceway Systems.

Weather tight conduit systems and equipment.

Connection of pumping and related equipment.

Modification of existing equipment

Conduit trenching and backfill, as shown on drawings.

Pump Control equipment, connection thereof.

Removal of existing power equipment as shown on the Plans.

Other work as specified herein or shown on Drawings.

Intent of Specification and Drawings:

It is the intent of this specification that all work shall be complete, tested and ready for operation unless specifically noted otherwise.

3. Codes and Standards:

All materials and workmanship shall comply with all applicable codes, specifications, state laws, labor union contracts, local ordinances, industry standards, utility company regulations and regulations of the State Fire Marshall. In case of difference between these and the contract documents, the most stringent shall govern. Contractor shall promptly notify Construction Manager in writing of any such differences.

The following industry standards, codes and specifications shall apply:

ANSI - American National Standards Institute

IPCEA - Insulated Power Cable Engineers Association

NEC - National Electrical Code as published by NFPA

NEMA - National Electrical Manufacturers Association

NFBU - National Board of Fire Underwriters

NFPA - National Fire Protection Association

OSHA - Occupational Safety and Health Administration, U.S. Department of Labor

UBC - Uniform Building Code as published by ICBO

UL - Underwriter's Laboratories, Inc.

IEEE - Institution of Electrical and Electronic Engineers

4. Materials and Equipment:

Where any specific material, process, method or manufactured article is specified, the specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance of the system to be installed. Where manufacturer's name and number is used, it is to designate a quality standard, and the words, "Or Approved Equal" are implied unless the designation is followed by the words, "No Substitutions", "No Sub", etc.

Where Contractor proposes use of items other than specified, any and all redesign required, including drawings or layouts, shall be the responsibility of Contractor. Any change required for associated equipment or to building structure shall be made at no additional cost to Carson City. Unless substitutions are requested and approved by Construction Manager, no deviations will be allowed. If materials are installed at the jobsite that were not specified and/or were not approved substitution items, such materials shall be removed and replaced with specified materials free of charge to Carson City or other contractors.

All materials and equipment shall be new, of the best quality for the purpose intended, and shall be clearly marked or stamped with the manufacturer's name and nameplate data or stamp and rating.

Materials and equipment shall be suitable for the use and service intended, for the system as designed, and for the conditions that may be encountered in actual operation. All electrical equipment shall be capable of operating at full rated load, without failure at an ambient temperature of 104°F and specifically rated for an altitude of 5000 feet.

Shop drawings shall be required on specific items that are listed in a particular subdivision. In general, shop drawings will be required for substitution equipment, large and/or intricate equipment, and other equipment and/or materials that are critical because of their nature and/or application. Shop drawings shall also include electric power diagrams, control diagrams, installation instructions, control and other ancillary component details, and/or other pertinent information to fully describe all aspects of the items

5. Examination of Site:

Contractor shall visit the site to satisfy himself as to the location and nature of the work, the character of equipment and facilities needed preliminary to the work and during prosecution of the work, and all other matters which can in any way affect the work, or the cost thereof under this contract. Failure by Contractor to acquaint himself with all available information concerning these conditions shall not relieve him from complying with the Specifications or Drawings, and no allowance shall be subsequently made in his behalf for any expense due to failure in this respect.

6. Accuracy of Date:

The data given here and on the Drawings is as exact as could be obtained, but absolute accuracy cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of Contractor;

therefore, exact locations, distances and elevations will be governed by the building itself and actual jobsite or field conditions.

7. Cutting, Patching, and Repairing:

All cutting, chipping, digging, drilling and patching that may be necessary for the proper installation of work specified or shown shall be included. All such work shall be approved by Construction Manager or his representative before starting any of the above operations.

8. Workmanship:

Where other instructions are not given, equipment shall be installed in accordance with the recommendations of the manufacturer and the best standard practice for that type of work.

9. Damage:

Contractor shall be responsible for damage to the work of other trades and shall guarantee to repair or replace with like materials free of charge to Carson City or other contractors, any existing work or equipment damaged during the progress of construction or tests.

10. Coordination of Work:

The work called for under this section shall be coordinated with that of all other crafts. It shall be this Contractor's responsibility to check all the contract drawings and specifications for possible conflicts between his work and that of other crafts in equipment location; pipe, duct and conduit runs; electrical outlets and fixtures; air diffusers; and structural and architectural features.

11. Waterproofing:

Where any work pierces waterproofing, including waterproof concrete, Contractor shall furnish all necessary sleeves, caulking, and flashing required to make openings absolutely watertight. The method of installation shall be approved by Construction Manager.

12. Operating and Maintenance Instructions:

Contractor shall submit three(3) complete sets of operating and maintenance instructions for all equipment, fixtures, and devices, that require maintenance and parts lists to Construction Manager for review. When the sets are complete and approved, all the sets will be forwarded to Carson City. Each set shall be in hard-cover, loose-leaf ring binders.

Instructions shall include a reduced scale schematic control diagram along with the description and function of each control and its location so that Carson City may readily determine how and where adjustments may be made. All special tools for the proper operation and light maintenance of the equipment shall be furnished to Carson City by Contractor.

Sets will normally contain complete information on all components included in the systems, and auxiliary components of major and/or complex equipment. All documentation, diagrams, specification sheets, installation instructions and the like which accompany every component, shall be maintained in a neat and clean manner on the jobsite. All such documentation shall be submitted to Construction Manager prior to the time of final acceptance.

Contractor shall instruct (if required) Carson City (or it’s representative) in the complete operation of all items of equipment. These instructions are to be given to Carson City by Contractor at Carson City's convenience.

13 Record Drawings:

Contractor shall maintain an up-to-date and complete record set of prints of the work at all times during construction. The prints shall be to show actual construction of the various systems. Contractor shall show, in red, any deviations in locations of ducts, pipes, conduits, equipment placement, etc., from the original design.

14 Vibration and Noise Control:

Every precaution shall be taken to ensure quiet and vibration-free operation of all mechanical and electrical equipment.

15 Standard Field Tests:

At completion of construction, Contractor shall demonstrate in the presence of Construction Manager, or his representative that all systems operate in accordance with the requirements of the specifications.

Contractor shall furnish all instruments and all personnel required for the tests and shall allow two (2) full working days for testing.

All equipment shall be tested in the presence of Construction Manager and as directed by Construction Manager.

Contractor shall furnish Construction Manager the required certificates of testing and the cost of all tests shall be paid by Contractor.

Work which fails to meet the requirements of any test and does not meet the requirements of the Contract Documents shall be considered defective and shall be promptly corrected or removed from the site.

The entire electrical installation shall be free from short circuits and improper grounds. Test panels and circuits with main disconnected from feeder, branches connected, switches closed, and all fixtures in place and connected for proper operation. Upon completion of the work, operate and test equipment under normal conditions, all to the satisfaction of Construction Manager.

15.1 The following tests and checks shall be performed on new, relocated or renovated equipment before it is placed in operation.

Check all bus and cable connections for proper contact pressure and mark each bolt to indicate it has been checked.

Check the equipment for mechanical adjustments, lubrications, and free operation. Remove all shipping blocks, hooks, loops, or eyelets etc.

Test all control circuits for correct connections and operation.

Perform rotation checks on motor circuits.

Check the polarity of receptacles, and test all GFIC protection receptacles.

Check circuits, feeder, and control circuits for correct connections. Check insulation resistance between phases and phase to ground using 500 volt megger.

15.2 Dynamic Operational Test:

As a condition of acceptance, the equipment installed under this contract shall operate in the normal (automatic) mode, under actual dynamic conditions, for seven (7) consecutive days - without failure.

15.3 Special Field Tests - Power:

Tests shall be complete enough to be conclusive and to ensure proper operation. This shall be certified in test reports submitted to Construction Manager. All faulty equipment shall be replaced and tested until satisfactory results are obtained.

Tests shall be nondestructive and procedures used shall be approved by Construction Manager.

Throughout entire installation, inspect and make all necessary tests, including those which Construction Manager may request to insure that drawings and specifications have been followed and that:

the electrical equipment is installed correctly;

the wiring system is free of all grounds and faulty connection;

and that the resistance between grounded equipment and true ground is not more than 10 ohms. Greater than 10 ohms will not be acceptable.

Insulation Testing: After the visual inspection of terminations and connections and the application of tape and other insulating materials, all sections of the complete system of wiring shall be thoroughly tested for shorts and grounds. Contractor shall correct all defects.

Each motor shall have its insulation resistance to ground measured with 500 volt "Megger" prior to connection, in the presence of Construction Manager. Construction Manager will make a record of these values, and values of resistance of less than ten megohms will not be acceptable. Motor rotation shall also be checked.

Insulation resistance measurements of each 480-volt circuit shall be made with loads connected and contactors, if any, blocked closed to give complete circuits. Insulation resistance of complete circuit shall be measured from the circuit breaker load terminals with the breaker open. Construction Manager will witness and make record of these values. Values of resistance of less than fifty megohms will not be acceptable.

Overload Protective Devices: Contractor shall compile, by visual inspection of equipment installed for each motor, the following data in neatly tabulated form:

1. Horsepower	4. Temperature rating
2. Nameplate amperes	5. Overload catalog number
3. Service factor	6. Overload current range and setting

Test each individual power circuit at the panel with the equipment connected for proper operation. Correct any deficiencies.

Check the service voltage at each panel under maximum load and under no load and arrange for proper voltage, if voltages and regulations are not within acceptable limits. Submit a report to Construction Manager showing service voltages and corresponding loads.

16 Identification:

Provide nameplates, labels, and signs to identify all equipment and circuiting. Wording and size of characters shall be approved by Construction Manager. This shall include but is not limited to items such as: panelboards, transformers, disconnects, starters, control stations, relays, time switches, special receptacles, remote switches, signal systems, conductors, and terminals. Nameplates shall be black lamicoid with white letters.

Use Dymo labels for identification of components located inside control cabinets.

Use Brady wire markers for identification of control circuit and signal circuit wiring. Use stenciled, typewritten or stick-on markers for terminal strips. Markers shall be slip-on PVC sleeve type as manufactured by Brady, Seaton, or Equal.

Use typewritten circuit directories for panelboards indicating type and location of load.

Nameplates shall be attached to the various devices using round head brass screws. Self-sticking nameplates and/or gluing shall not be used.

17 Sleeves and Plates:

Provide sleeves wherever openings are required through new concrete or masonry members. Place sleeves accurately and coordinate locations with structural work.

Direct Burial Underground Raceways:

Underground rigid steel conduit shall be PVC coated or wrapped.

Use rigid steel conduit for terminations extending above grade, including elbows against which pulling wire will rub.

Installation of green insulated ground conductors in all non-metallic conduits is acceptable.

Direct burial conduit shall be used only where listed on the Drawings.

18 Conduit Systems:

Provide Schedule 80 conduit for exposed work within five feet of exterior grade, within masonry or concrete structure located above grade.

Locknuts shall be steel or malleable iron. Bushings shall be metal with insulated throats.

EMT connectors and couplings shall be compression type. Connectors shall have insulated throat bushings.

Size shall be as indicated on the Plans, or required by the NE code for number and size of conductors installed.

Joints shall be cut square, threaded, reamed smooth and drawn up tight. Bend or offsets shall be made with standard elbows. Field bends shall be made with an approved bender or hickey. Number of bends per run shall conform to Code limitations.

Raceways shall be continuous from terminal to terminal and terminated with connectors, hubs, or locknuts and bushings in such manner that each shall be capped to prevent entrance of foreign materials during construction. Install systems completely before conductors are pulled in. Cap ends during construction.

Conduits shall be securely fastened in place with hangers, supports or fastenings provided at each elbow and at the end of each straight run terminating at a box or cabinet. Horizontal and vertical conduit runs may be supported by one-hole malleable straps, clampbacks, or other approved devices with suitable bolts, expansion shields or beam-clamps special brackets for mounting to building structure. Perforated iron strap and iron wire shall not be used for supporting conduits. Strength of the supporting equipment and size and type of anchors shall be based on the combined weight of conduit, hanger and cables with a safety factor of four.

Transitions between nonmetallic conduits and conduits of other materials shall be made with the manufacturer's standard adapters and designed for such purpose.

19. Flexible Conduit:

Provide liquid-tight flexible conduit with liquid-tight connectors for short connections to motors and devices requiring adjustment or subject to vibration. Maximum length is three feet. Provide bonding jumpers within conduit and attach to terminating boxes and equipment to ensure continuity of ground. **Solid wire shall not be installed in flexible conduits.**

600 Volt Wire and Cable in Raceways:

Conductors shall conform to the requirement of the current edition of the Code's U.L. Standards. The size, type of insulation, voltage rating, and manufacturer's name shall be permanently marked on the covering at regular intervals.

Conductors shall be standard American Wire Gauge, soft-drawn copper; #12 and smaller may be solid; #10 and larger shall be stranded. Unless otherwise noted, minimum size shall be #12. Except where specifically noted, **aluminum conductors shall not be installed.**

Insulation shall be rated 600 volts. Unless otherwise noted, #14 through #4/0 cable insulation shall be type THW, THWN or THHN. All interior wiring in dry locations may be type TW in sizes up through #4.

Color code conductors consistently throughout the electrical system. All wire/conductors shall be full length, integral color pigmentation insulation in various colors and wire sizes up through at least #10, to indicate phase, voltage and/or duty in order to maximize safety in the system. Except when first approved by Construction Manager on submittal, no deviations will be allowed. Where integral pigmentation colors, other than black, white, and grey are not available, use colored plastic tape applied in a spiral halflap manner over exposed conductor portions in manholes, boxes, panels, switchboards, and other enclosures. Use only black insulated wire for power conductor, and apply at least 4 turns of identification color tape.

Only the integral color pigmentation insulation designated for neutral conductors will be allowed throughout the full length. Wherever bonding or grounding conductors are in raceway with other conductors, only green pigmentation insulation for the full length will be allowed. Color for control wires shall be red.

TYPICAL CONDUCTOR COLOR CHART		
CONDUCTOR	**SYSTEM VOLTAGE**	
	227-480	**120-240-208**
Phase A	Brown	Black
Phase B	Orange	Red
Phase C	Yellow	Blue
Neutral	Grey	White
Equipment ground & bond	Green	Green

Install wire and cable in conduits, ducts, or raceways after the raceway system has been completed. Exercise care to prevent damage to conductor or insulation. Cable lubricants shall be approved for the type of cable.

Cables and conductors shall be continuous from origin to equipment without running splices in intermediate pull or splice boxes. Where taps and splices are necessary and approved, they shall be made in approved splice boxes with suitable connectors as noted herein.

The Electrical Contractor shall furnish and install all hangers racks, cable cleats, and supports required to make a neat and substantial cable installation.

20. Conductor Terminations and Splices:

Use solder-less pressure-type connectors, unless otherwise specified. Connectors shall be Scotchlok for wire size No. 14 through No. 8, Burndy type KVS for cable #6 and larger.

Where compression-type connectors are noted on Plans, they shall be of the type as manufactured by Burndy Company, and shall be installed with approved hydraulic tools to assure a permanent mechanically secure high-conductivity joint.

Where conductors are to be connected to metallic surface, the coated surfaces of the metal shall be polished before installing the connector. Lacquer coating of conduits shall be removed where ground clamps are to be installed.

Each conductor cable group in panels, pull boxes, or troughs shall have a permanent tape or pressure-sensitive label with suitable numbers and letters for easy identification.

21. Utilities:

All contractors shall contact the utility companies which provide services to the site. Each shall pay for any additional service connections, and shall provide piping, valves, meters, pits, detector checks, conduit, service drops, pull boxes, trenching and backfill, and/or other appurtenances required by the utility company.

Contractors shall coordinate with the electrical utility to establish clockwise phase rotation (A-B-C) at each three phase service installation.

22. Concrete Work:

Provide concrete work for duct banks, electrical equipment bases, unless specifically noted otherwise.

All concrete work shall conform to Technical Specification Doc No. 4001, “Concrete Structures”.

23. Telemetry:

Electrical Contractor shall coordinate with Construction Manager for installation of conduit and wiring systems which interface with telemetry equipment.

Carson City shall bear responsibility of installation, alignment and testing of all telemetry equipment.

Contractor shall notify Construction Manager, if it should become necessary to move, alter, adjust, modify, or disconnect any existing telemetry equipment. Carson City shall effect necessary changes.

24. Demolition:

At the completion of the installation, testing and acceptance of all new facilities, Contractor shall obtain permission of Construction Manager to begin disassembly and demolition of the old facilities, if any.

All electrical equipment and appurtenances shall remain the property of Carson City, except those items noted on the plans (those items left for disposal) or those which are required and supplied by Contractor to maintain the energy service as necessary to operate the existing facilities while construction is in progress. Such other equipment as removed from the site shall be disposed of at an approved disposal location.

Contractor shall make every effort to coordinate demolition with Carson City and shall take care to deliver all salvaged equipment to Carson City without damage and in good working condition.

25 Service Change:

Contractor shall coordinate his work with Sierra Pacific Power Company (SPPCo.) for the installation of all power requirements including temporary power as required at all the Construction Site(s). Contractor shall provide all additional items as necessary to maintain power at all existing stations, if any, until the full and satisfactory operation of the new system and authorization of Construction Manager.

Contractor shall notify Construction Manager Forty Eight (48) hours prior to any shut-down of power to any segment of the functional system.

Contractor shall coordinate his work with Nevada Bell for the installation of all required telephone services or modifications thereof.

26 System Start-Up:

After all testing has been completed to the satisfaction of Construction Manager, Contractor shall notify Construction Manager, Twenty Four (24) hours prior to start-up of the new system, for start-up instructions.

END OF DOCUMENT 6007

Document No. 6008 ELECTRICAL SERVICES (6/10/02)

1. General Information:

1.1 Description:

These standards provide trench configurations and general requirements and guidelines for trenching and excavation for pipe, conduit, cable, box, and vault installations within the electric utility's, Sierra Pacific Power Company (SPPCo.), service territory.

1.2 Jurisdiction:

All applicable City, County, State, and Federal Specifications must be met in addition to the requirements of this standard. In the case of conflict, the more restrictive specification or standard shall apply.

2 Trenching Guidelines:

2.1 Trenching Configurations:

Trench configurations for electrical conduit installations up to the meter main shall be installed as per the most current SPPCo. Details and Specifications. In cases where a typical configuration does not apply, Contractor shall contact SPPCo. engineering department for an approved detail.

2.2 Trench Separations:

All new electrical facilities shall be installed with a minimum of twelve inches (12") of vertical clearance and 5 feet of horizontal clearance from any new or existing water lines. If the new electrical facility is above a new or existing water line, then the new electrical shall be encased with a light weight concrete slurry, 5 feet both sides of the crossing as per SPPCo. details and specifications.

2.3 Trench Locations:

Trench locations are typically shown relative to street center line, right-of-way lines, or property lines in new and existing developments. It is the responsibility of Contractor to verify that these reference lines are established and are accurate. Where such references are unavailable, alignment shall be established by SPPCo. and Construction Manager.

2.4 De-watering:

Where groundwater is encountered during trench excavation, it shall be the responsibility of Contractor to adequately de-water the trench to provide for dry, safe and convenient installation of the pipe, conduit, and/or cable.

2.5 Other Utilities:

2.5.1 Joint Trenches:

Joint trench construction shall be by mutual agreement of all parties involved. Coordination of separate utility installations in a joint trench shall be by Contractor.

2.5.2 Existing Utilities:

Prior to commencement of excavation, Contractor shall telephone the Underground Service Alert (U.S.A.) at 1-800-227-2600. After existing utilities have been located, extreme caution shall be exercised while excavating in their vicinity. Once exposed, pipes, conduits, and cable shall be shored or supported as necessary to prevent damage. The full cost of repair or replacement of damaged utilities shall be borne by Contractor.

2.6 Installation Procedures:

Pipes, conduits, and cables shall be installed in the trench, in accordance with the manufacturer's recommended procedures, SPPCo. Specifications, and/or standards and accepted practices.

2.7 Box and Vault Installation:

2.7.1 Excavation:

Excavation for boxes and vaults shall be performed by Contractor concurrent with adjacent trench excavation, unless otherwise directed by the SPPCo. engineer, planner, or inspector. Size, depth, and alignment of the excavation shall be as shown on the attached standard drawings.

2.7.2 Dewatering:

Where groundwater is encountered during excavation, it shall be the responsibility of Contractor to adequately de-water the excavation to provide for dry, safe and convenient installation of the box or vault.

2.7.3 Installation:

Large boxes and vaults shall be installed using equipment with adequate load capacity to safely handle the components. No personnel shall be in the excavation during placement. All boxes and vaults shall be set level, squarely aligned with existing or proposed improvements and with the top 1 inch above finish grade in unpaved areas, 1/4 inch below finish grade in paved areas, and flush in sidewalks.

2.7.4 Bedding and Backfill

Boxes and vaults shall be bedded and the surrounding excavation backfilled, in accordance with SPPCo. Specifications and details.

3 Transformer Pad Installation:

3.1 Excavation:

Excavation for transformer pads shall be performed by Contractor or customer concurrent with adjacent trench excavation, unless otherwise directed by the SPPCo. engineer or inspector. Size, depth, and alignment of the excavation shall be as shown on standard drawings.

3.2 Dewatering:

Where groundwater is encountered during excavation, it shall be the responsibility of Contractor to adequately de-water the excavation to provide for dry, safe and convenient installation of the transformer pad.

3.3 Installation:

Large transformer pads shall be installed using equipment with adequate load capacity to safely handle the components. All transformer pads shall be set level, squarely aligned with the base at existing or proposed finish grade, and installed as per SPPCo details.

3.4 Bedding and Backfill:

Transformer pads shall be bedded and the surrounding excavation backfilled, in accordance with SPPCo. Specifications and Details.

END OF DOCUMENT 6008

Document No. 7003 RIPRAP (4/18/08)

1. Scope of Work:

Rock Rip Rap shall be per Section 200.07, Rip Rap, of the Standard Specifications and these Technical Specifications.

2. Quality:

Individual rock fragments shall be dense, sound and free from cracks, seams and other defects conducive to accelerated weathering. The rock fragments shall be angular to subrounded in shape. The least dimension of an individual rock fragment shall be not less than one-third (1/3) the greatest dimension of the fragment.

Except as provided below, the rock shall have the following properties:

Bulk specific gravity (saturated surface-dry basis not less than 2.5.)

Absorption not more than two percent (2%).

Soundness - weight loss in 5 cycles not more than ten percent (10%) when sodium sulfate is used or fifteen percent (15%) when magnesium sulfate is used.

The bulk specific gravity and absorption shall be determined by ASTM method C 127. The test for soundness shall be performed by ASTM method C 88 for course aggregate.

Rock that fails to meet the requirements stated above may be accepted only if similar rock from the same source has been demonstrated to be sound after five (5) years or more of service under conditions of weather, wetting and drying, and erosive forces similar to those anticipated for the rock to be installed under this Technical Specification.

3. Grading:

The rock riprap shall conform to the specified grading limits as shown on the Plans.

END OF DOCUMENT 7003

Document No. 9000 LANDSCAPE GRADING (6/15/04)

1. General:

1.1 Description:

Drawings and General Conditions of these Contract documents, including Special Conditions apply to this section.

1.2 Related Documents:

1) Document No. 9001 Landscape of these Technical Specifications

2) Document No. 9002 Irrigation System of these Technical Specifications

2. Scope of Work:

Excavation and removal of existing soil, rock debris, or base material to achieve rough grade.

Installation of an approved topsoil mix to achieve finish grade.

Fine grading of all sod lawn areas, perennial areas, and landscape planting beds to a smooth and even finish elevation.

Contour finish grades to drain water away from all structures and to prevent ponding of water in lawn and planting bed areas.

3. Rough and Finish Grade Requirements:

After Contractor has installed any required imported top soil, it shall be spread evenly over the site planting areas and lawn areas.

Refer to the Landscape Architects' drawings for more information on fine grading requirements.

Fine grading shall consist of the following: Raking smooth to clear and grub areas to even out the low points in all planting areas and all lawn areas. Removing rocks and debris 1" in diameter and larger.

1) Mulch Areas: Finish grade to be 4"-6" below top of concrete sidewalks or mow strips. 4"-6" rock mulch material depth.

2) Sod Lawn Areas: Finish grade to be 1 1/2" below top of concrete sidewalk or mow strips.

No planting of trees , shrubs, seeding or sodding shall commence until final grade is achieved and approved by Construction Manager or Carson City's Representative.

4. Protection:

Protect all existing site structures, landscaping, amenities, paving, on-site vegetation and other features remaining as final work.

5. Measurement and Payment:

No direct payment will be paid for the landscape grading done in conjunction with installation of any irrigation, or landscape work.

6. Products:

6.1 Materials:

Soil Amendments: See landscape specifications.

7. Execution:

7.1 General:

Verify site conditions and note any irregularities affecting work of this section. Notify Construction Manager of any problems or irregularities before beginning installation of required imported topsoil, soil amendments and fine grading.

Starting work means acceptance of existing conditions.

8. Clarification:

These Contract documents do not intend to show all objects existing on site.

Before commencing the work of this Section, verify with Construction Manager all objects to be removed and all objects to be preserved; including all limits of construction.

Contractor is responsible for avoiding damage to all underground and above ground utilities and existing conditions that will remain as part of the finished product.

9. Scheduling:

Schedule all work in a careful manner with all necessary consideration for construction trades, Carson City, and Public.

Avoid interference with pedestrian and vehicle use within the project site.

10. Protection of Utilities:

Preserve in operating conditions all new and active utilities traversing the site and designated to remain and maintain all facilities/devices to be abandoned in an operational state until such time as they are no longer in use.

Contractor shall repair or replace at his expense any site elements, plant materials or utilities damaged by his operation.

11. Preparation of Fine Grade:

Leveling: Contractor shall remove all large rock, ruts, hummocks, and other uneven surfaces in the fine grade after incorporation of required soil amendments.

12. Excess Water Control:

12.1 Unfavorable Weather:

1) Do not place, spread, or roll any fine grading soil fill material during inclement weather conditions, particularly in windy conditions.

2) Do not resume operations until moisture content is satisfactory to Construction Manager.

13. Landscaping and irrigation trenches:

Compaction and backfill of all irrigation and landscaping trenches shall conform to the most recent edition

of “Standard Specifications for Public Works Construction” as adopted by Carson City.

14. Jetting:

Unless specifically approved in writing by Construction Manager, jetting will not be permitted.

15. Grading:

15.1 General:

Except as otherwise directed by Construction Manager, perform all finish grading required to attain the elevations indicated on Construction Managers drawings.

16. Landscape Planting Areas:

All finished areas which are to receive landscape plant material shall be graded to within the required grade elevations in the grading specification and all grades shall be free from irregular surface changes. The degree of finish in all landscape planting bed areas shall be that ordinarily obtainable from a hand shovel and rake operation. Exposed roots shall be cleanly cut, covered from sunlight and kept moist and cool until backfilled.

17. Treatment after completion of grading:

1) Contractor shall clear sod lawn areas and planting beds of all roots, weed, debris and rocks larger than 1" in diameter. This material shall be hauled off the site and disposed of properly.

2) After fine grading is completed and Construction Manager has finished his inspection, further excavation, filling, or grading, except with the approval of Construction Manager, is not permitted.

3) Use all means necessary to prevent the blowing or erosion of freshly graded areas until construction is complete. These activities shall continue until such time as the installation of plant material and mulch cover. (As per requirements of the Nevada State Environmental Protection Agency, Air Quality Division (775) 687-4670.)

18. Drainage:

All areas shall be sloped to sheet drain away from any building, as per the Landscape Architect’s drawings. If grades are not specified on the Landscape Architect’s drawings, provide minimum positive drainage with a minimum fall not less than four (4) inches and a maximum fall of not more than eight (8) inches for every ten (10) feet. The measurement shall be between the landscaped areas and the top of the mow strip or edge of sidewalk.

END OF DOCUMENT 9000

Document No. 9001 LANDSCAPE (5/21/07)

1. General:

1.1 Description:

Drawings and General Conditions of these Contract documents, including Special Conditions apply to this section.

Contractor shall, at his expense, verify the locations of all new and existing utilities; before any digging or construction begins whether shown on the drawings or not, and shall be responsible for any and all damage and repair to the same.

Contractor is responsible for the acquisition of all necessary permits associated with the project construction.

It is the responsibility of Contractor prior to submitting a bid for the work under these Contract documents and specifications, to review the drawings and visit the site to familiarize himself/herself with the site conditions, means of getting material onto the site and any other factors affecting the work.

The work shall consist of furnishing all labor, materials, services, tools, equipment and incidentals and performing all of the work required in accordance with these Contract documents and as specified herein, including incorporation of required imported topsoil/soil amendments into rough grade, sodding of lawn areas, excavation of tree and shrub pits, furnishing, planting and fertilizing all plant material, furnishing required imported topsoil, mulch installation, replacement of damaged or unhealthy plant material, protection of existing trees, preparation and planting of all plant material and maintenance of the project site and all landscaping materials for the duration of the project until Final Project Acceptance as specified elsewhere in these specifications. The work shall be performed in accordance with the best standards of practice relating to the various trades and under the continuous supervision of a competent foreman, capable of interpreting these Contract documents and these specifications.

Finish Elevations: Excavation, filling and grading, as required, to establish landscape planting bed elevations and lawn area finished grades as shown or detailed on project drawings. Coordinate all work with the Contract drawings in order to arrive at a finish grade that will allow tolerance for required imported topsoil and soil amendments, mulch treatments as required, in other sections of these specifications.

Owner: Means the Carson City Public Works Department.

2. Related Documents:

Document No. 9000 Landscape Grading of these Technical Specifications

Document No. 9002 Irrigation System of these Technical Specifications

No work shall be performed without approval of Construction Manager.

Prior to commencing site operations, Construction Manager shall review and verify with Contractor all pertinent landscape issues regarding the project site.

All existing vegetation designated to remain as part of the final product shall be protected. Contractor shall protect and preserve all remaining existing trees, after those marked for removal have been removed. Tree protection shall include: no vehicle or equipment storage and no trenches or grading will be allowed within the drip line of any of the existing trees. All tree roots that may become exposed shall be cleanly cut and covered from sunlight; keep moist and cool. Roots greater than 2" diameter shall be tunneled under, rather than cut. Significant damage to or loss of any trees will result in Contractor being required to furnish and install, at no cost to Carson City, replacement tree(s) (with premium grade nursery stock - min. size 3" caliper or 8' ht b & b) on a 4:1 basis. (Four new trees as selected by Carson City’s representative, to be

planted for each existing tree significantly damaged or lost) The determination of whether a tree is "significantly damaged or lost" will be made by Carson City's Arborist, and that determination shall be final and is not debatable.

Contractor shall arrange for transportation and delivery of the trees and shrubs to the project site. After Final Project Acceptance Contractor shall assume a full one (1) year warranty on the trees and shrubs and guarantee that they will remain healthy and continue to grow. Construction Manager in conjunction with Carson City shall determine if a plant is in a healthy growing condition. If it is not, Contractor, at his expense, shall replace the plant immediately. The replacement plant shall remain under the one (1) year warranty period as per the original plant. Replacement plantings shall be conducted to achieve original planting quality and densities.

All landscape and irrigation work shall be performed by a licensed C-10 Nevada Contractor.

Contractor shall, at all times, have on the job site a Foreman fluent in understanding and speaking the English language.

3. Quality Assurance:

3.1 Inspections:

Site inspections of the landscape construction project shall be required for the following parts of the work:

1) Inspection of shrubs and trees upon delivery and prior to unloading.

2) Inspection of the final location of all plant material prior to installation.

3) Inspection upon final placement of all Contractor supplied materials.

4) Punch List – Final Project Acceptance.

All inspections and reviews specified herein shall be made by Construction Manager. Contractor shall request inspection at least two (2) working days in advance of the time the inspection is required.

Such reviews shall not impair the right of inspection and rejection during the progress of work.

Construction Manager reserves the right to refuse any plant material, the type of rock mulch, products, or work related to this project that is not in accordance with these Contract documents or these specifications.

All landscape plant material quality and size shall conform with NRS 555 and the current edition of "american Standard for Nursery Stock" for number one grade nursery stock as adopted by the American Association of Nurserymen. In all cases, botanical name will take precedence over common name.

Ship landscape materials with Certificates of Inspection required by governing authorities. Comply with all regulations applicable to landscape materials.

4. Submittals:

4.1 Certification:

Submit Certificates of Inspection as required by governmental authorities. Submit other data substantiating that materials comply with the specified requirements. Such certificates may be tags, labels, and/or manufacturer's literature. All submittals shall be approved before Contractor begins work.

4.2 Planting Schedule:

Submit a proposed landscape construction and planting schedule for approval by Construction Manager, indicating installation dates for each type of work. Correlate maintenance period with installation of plant material to provide maintenance until Final Project Acceptance. Provide any necessary information required by Carson City. To prevent frost damage to new plantings, no plant installation shall occur after the ground begins to freeze each night (normally in early November).

4.3 Maintenance Instructions:

Submit typewritten instructions recommending procedures to be established by Carson City for maintenance of all landscape plantings and landscape work for one (1) full year after Final Project Acceptance. Submit preliminary draft to Construction Manager for review prior to Carson City beginning maintenance. Provide Construction Manager with three (3) copies each of the final maintenance instructions.

Contractor shall notify Construction Manager, in writing, of the source of all plant material including address, phone number, and a contact person. Plants may be required to be inspected at the nursery before delivery.

Contractor may submit to Construction Manager pictures of all trees listed on the plant list before ordering. Carson City Parks and Recreation Department encourages submittal of pictures to facilitate plant ordering and quality control.

4.4 Delivery, Storage and Handling:

Packaged Materials: Deliver packaged materials in original containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at the project site.

Protect all plant material at all times from sun or drying winds, as necessary, until planted. Plants shall not be handled by unprotected root balls, stems, trunks, or tops, but only by the container.

Protection against drying out: If landscape planting is delayed more than six (6) hours after delivery, set trees, shrubs and sod in the shade, protect from weather, mechanical damage, or other injury and keep roots moist by watering, as needed, and by covering with mulch, burlap or other acceptable means of retaining moisture. Do not permit roots to dry out for any reason. Required delivery dates shall be included in the project schedule provided by Contractor.

Contractor shall make arrangements with all vendors for delivery time and dates of all plant material. Upon delivery to the job site, plant material will be inspected by Contractor and Construction Manager for acceptance. Plant material being accepted shall be the responsibility of Contractor to maintain and store until planted.

Do not remove container grown stock from containers until planting time.

Where water is not available from an irrigation source, Contractor shall make arrangements to supply water at no cost to Carson City.

Shipment and Delivery: Contractor shall promptly notify Construction Manager in advance, when the plant material will be delivered and the manner of shipment. When shipment is made by truck, all plant material shall be packed to provide adequate protection against direct exhaust fumes emitted from the delivery truck, climatic, seasonal and breakage injuries during transit. The tops shall be securely covered with tarpaulin or canvas to minimize wind whipping and drying. Shipments to local or nearby freight yards shall be given special attention to insure prompt delivery and careful handling therefrom to the point of final delivery at the job site. Improper handling of freight may be deemed grounds for rejection by Construction Manager.

Watering for the plant material or nursery storage shall be such as to preserve the growth and health of the plant. Plants not watered over any 24 hour period may be rejected by Construction Manager.

4.5 Performance Standard:

Landscape Planting Performance Standards: Contractor shall guarantee all landscape plant stock (trees, shrubs, perennial, ground covers and other plant material) to take root and grow, and thrive (be alive and in healthy condition) for a period of one (1) year after the Final Project Acceptance.

All plant material shall be replaced promptly when it has died or is not in a vigorous and healthy growing condition, as determined by Construction Manager except for plant losses due to vandalism or neglect by Carson City. Such replacement, shall be without additional cost to Carson City and shall be inspected prior to planting. All of replaced material shall meet the same specifications as the original plantings. Contractor shall repair any damage created during replacement operations to the satisfaction of Construction Manager and at no cost to Carson City.

Provide a uniform stand of grass by watering, mowing, and maintaining sod lawn areas until Final Project Acceptance. Re-sod or reseed lawn areas (with specified materials) which fail to provide a uniform stand of grass until all affected areas are accepted by Construction Manager.

5. Inspection of Plants:

5.1 Landscape Plant Material:

The species (scientific and common names), size, manner in which to be furnished and indication of the approximate number required to complete the planting are shown on the planting plan. Contractor shall furnish and plant all plant material required by the drawings. Surpluses or shortages on the plan shall not be used for claims for additional compensation. The right is reserved to reject any plants considered unsatisfactory. All plant material are subject to inspection and approval by Construction Manager.

5.2 Plant Material Substitutions:

Plants other than those named in the plant list or size changes of those plants will not be accepted unless specifically approved in writing. Proposed substitutions in each case must possess the same essential characteristics as the kind of plant actually specified in regards to appearance, ultimate height, shape, habit of growth, general soil, and other requirements. Size substitution may be permitted if approved by Construction Manager. All plant substitutions or size changes must be approved in writing by Construction Manager before construction begins and the plants are ordered.

5.3 Plant Health:

All plant material shall be free of damage. Foliage, roots and stems of all plants shall be of vigorous health and normal habit of growth for its species. All plants shall be free of insect infestations and diseases. Top growth shall be appropriate for bottom growth. “Leggy” or floppy growth on shrubs or perennials shall be pruned back two weeks prior to installation.

Plant maintenance operations shall begin immediately after each plant and sod lawn area is planted. Contractor shall have full responsibility for the proper care of the sod lawn areas and plants until Final Project Acceptance and Contractor is relieved of all maintenance responsibilities.

5.3.1 Final approval on all deciduous trees shall meet the following criteria:

1) Size: Provide trees of uniform height, spread and caliper indicated by the current edition of the American Standard for Nursery Stock: Type 1 shade trees.

2) Where shade trees are required, provide single-stem trees with appropriate trunk taper (i.e. larger caliper at base and smaller caliper at first branch) and intact main leader, height of branching shall bear a relationship to the size and kind of tree so the crown of the tree will be in good balance.

3) Where small trees of upright or spreading type are required, provide trees with single stem, branched naturally according to species and type, and with relationship of caliper and branching recommended by the current edition of the current edition of the American Standard for Nursery Stock.

5.3.2 Final approval on all deciduous shrubs shall meet the following criteria:

1) Size: Height/Dimensions shown or indicated on contract documents.

2) Form: Provide deciduous shrubs with not less than a minimum number of canes required by the current edition of the American Standard for Nursery Stock.

5.3.3 Final approval on all evergreen trees and shrubs shall meet the following criteria:

1) Size: Provide evergreen trees of the sizes shown on these Contract documents with full branching structure and oversized root balls. Dimensions for spreading and semi spreading evergreen shrubs and height for other types, such as globe, dwarf, cone, pyramidal, broad upright, and columnar shall conform to the current edition of the American Standard for Nursery Stock. Provide evergreen trees and shrubs with a well balanced form that complies with requirements for other size relationships to the primary dimension indicated.

2) Form: Provide quality evergreen trees unless indicated as “specimen”.

3) Where indicated as “specimen”, provide exceptionally heavy, well-shaped evergreen trees of following grade: Heavy Grade “XX”

4) Roots: No circling, girdling or “J” roots

5.3.4 Requirements for Balled and Burlapped Stock:

1) General: Where indicated to be balled and burlapped, provide trees and shrubs dug with firm, natural ball of earth in which they were grown.

2) Provide ball size of not less than diameter and depth recommended by the current edition of the American Standard for Nursery Stock for type and size of tree or shrub required to encompass fibrous and leading root system necessary for full recovery of trees and shrubs subject to unusual or non typical conditions of growth, soil conditions, or horticultural practice.

5.3.5 Requirements for Container Grown-Stock:

1) General: Where specified as acceptable, provide healthy, vigorous, well-rooted (but not root-bound) trees or shrubs established in container in which they are sold.

2) Established container stock is defined as a tree or shrub transplanted into container and grown in container for a length of time sufficient to develop new fibrous roots, so that root mass will retain its shape and hold together when removed from the container. Container-grown plants shall have sufficient roots to hold soil together after removal from containers without kinked, circling, or J roots, and without being root-bound.

3) Containers: Use rigid containers that will hold ball shape and protect root mass during shipping. Provide trees and shrubs established in containers of not less than minimum sizes recommended by the American Standard for Nursery Stock for kind, type, and size of trees and shrubs required.

Plant material characteristics to be checked include size, vigor, shoots and leaves or buds that are firm and healthy. **If the top is acceptable, then a check of the roots of the container stock will follow. Roots of balled and burlapped plant material cannot be checked until time of planting.** It is Contractor’s responsibility to send the required specifications listed in the General Landscape Notes to the supplier. With container plants, 50 percent of each species will be checked for kinking, circling, club, and J

roots.

Trunk development in container plants will be tested. If the tree is staked, it will be untied from its support. If the crown of the tree bends over sharply and cannot support itself, the tree will be rejected.

If the plants pass these tests, a minimum of one per species or three percent of each species will be checked by washing out some of the soil to check the container roots to be sure they are free from kinking, circling, club, and J roots.

The peripheral roots will be inspected by cutting the container or slicing the root ball from its tapered container. Small to medium diameter roots that are supple and not densely entwined around sides are ideal. Numerous large roots that are rigid and matted around the sides at the bottom of the root ball will need to be pruned severely at planting. A plant with such roots will have to be watered carefully throughout the post planting care period.

6. Products:

6.1 Materials Other Than Plants:

1) All planting bed areas shall have installed 3” – 8” washed round river cobble placed over specified weed fabric. In the plant material water basin areas install rock mulch of 1 ½” - 2” washed round river rock or an approved equal.

2) Grass sod: Sod shall be a bluegrass/rye grass mix approved by Construction Manager.

3) Grass Seed: Grass seed for topseeding shall be Agrono-Tec brand Ballfield 4A Mix by the Agrono-Tec Seed Company (Phone 1-800-543-4109).

4) Tree Stakes: All trees shall be staked. Refer to the landscape construction details.

5) “I.B.D.U.” water-soluble starter plant fertilizer bags / tablets, or an approved equal, shall be installed in all planting pits. Use 1 per 1 gallon container, 3 per 5 gallon container, and 5 per 15 gallon container, 2” caliper or larger. Install 2” – 3” below finish grade.

6) Imported Topsoil: During fine grading or scarification operations, should the need arise for additional topsoil, it shall be Nevada Organic Premium Topsoil Mix (or an approved equal).

7) Weed Fabric: Contractor to install a Dewitt 5 Pro weed barrier (or an approved equal) in all landscape planting beds. Secure weed barrier to finish grades per manufacturer’s recommendations.

7. Execution:

7.1 Order of Work:

Project area soil excavation and establishment of rough grade by Contractor.

Landscape and irrigation construction work shall progress in the order outlined below.

1) Verify locations of existing irrigation sleeves and install additional sleeving for the irrigation system.

2) Scarify all landscape planting beds.

3) Install irrigation mainline, electric valves and control wires in all lawn and landscape planting bed areas.

4) Topdress rough grade of all lawn areas with 2” of topsoil. Incorporate imported topsoil into all lawn

areas rough grade to provide a soil transition between native soil and imported topsoil. Again, topdress all lawn areas with an additional 2” of topsoil to establish finish grade.

5) Install Irrigation Controller.

6) Plant all landscape containerized plant stock.

7) Install irrigation system drip lines and emitters to the base of the landscape plant material (trees, shrubs and groundcovers) fine grade all landscape areas after plant material installation.

8) Install irrigation spray system to all lawn areas; fine grade all lawn areas before seeding / sodding.

9) Install weed barrier.

10) Apply mulch treatments.

11) Install sod areas/repair damaged sod areas.

12) Topseed turf areas turf areas designated for top seeding repairs.

13) Hydroseed areas shown on drawings for hydroseeding.

14) Site clean up.

15) Punch list and Final Project Acceptance.

7.2 Site Inspection:

Before beginning work, Contractor shall carefully inspect the existing grades and the installed work of other trades and verify that the lawn and landscape planting may begin in accordance with these Contract documents.

Should existing project conditions, sub-surface drainage or soil conditions be encountered which would be detrimental to the growth or survival of the plant material, Contractor shall notify Construction Manager in writing, stating the conditions and submitting a proposal covering the cost of correction. If Contractor fails to notify Construction Manager of such conditions, he shall be responsible for plant material under the Guarantee Clause of these Specifications.

Verify site conditions and note any irregularities affecting future site work. Notify Construction Manager of any problems or irregularities before landscape construction begins.

Beginning irrigation or landscape planting work means acceptance of existing site conditions.

Proceed with installation of landscape planting work as rapidly as portions of the site become available, working within seasonal limitations for the landscape work required.

Determine location of all underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Construction Manager before planting.

Install plant material up to the close of the “planting window” and prior to ground freezing for the landscape work required. (Can be as late as early-November if approved by Construction Manager). Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion until Final Project Acceptance.

Contractor shall be responsible for the location of all underground utilities whether indicated on the drawings or not shown before construction begins. If any damage occurs, it is Contractor's responsibility to repair and/or replace the material immediately so that service is not disrupted.

All trees and shrubs shall not block or interfere with lights, signs, etc., when installed. Any conflict shall be brought to the attention of Construction Manager.

7.3 Preparation of Rough Grade:

Scarify by ripping and turning the soil over in all lawn areas' rough grade to a 6" - 8" depth.

All required topsoil amendments shall be incorporated into the scarified rough grade.

Topdress rough grade of all lawn areas with 2" of topsoil. Incorporate imported topsoil into all lawn areas rough grade to provide a soil transition between native soil and imported topsoil. Again, topdress all lawn areas with an additional 2" of topsoil to establish finish grade.

Remove from all landscape planting bed areas and all lawn areas any roots, large rocks or debris that is brought to the surface as a result of establishment of either rough grade or finish grade. Cleanly cut roots that remain.

7.4 Seed and Sod lawn Area Preparation:

All lawn areas shall be cleared and raked as per the landscape grading section.

Fine grade soil as directed by Construction Manager, also providing positive drainage away from all buildings. Maintain levels, profiles and contours of existing grades.

Remove any stone 1" in diameter and larger, roots, grass, weeds, debris, and foreign material while fine grading.

Manually spread soil around existing trees and vegetation, site elements, existing asphalt parking lot edge and new concrete sidewalks and mow strips to prevent damage. Add additional topsoil to lawn areas to establish necessary grades.

Remove any unused surplus soil from site.

Leave site clean, raked, and ready to receive seed or sod.

7.5 Sod Lawn Installation:

Place required imported topsoil in areas where sod lawn areas are shown on the drawings.

Use topsoil with organic matter in relatively dry state. Place during dry weather.

Roll placed soil to even out finish grade surfaces. Do not compact soil.

Remove surplus subsoil and topsoil from site.

Leave site clean and raked ready to receive sod.

Fine grade to a uniform finish, removing all surface rock larger than 1" diameter. Roll all sod lawn areas uniformly to approximately 80% compaction. Do not over compact.

Install sod so all joints are tight and smooth on a smooth, moist lightly compacted surface. Lay sod such that long edges are parallel to contours and perpendicular to slope. Alternate joints in running bond

pattern. Contractor to apply a nitrogen, phosphorous, and potassium fertilizer in amounts recommended in a soil reports from a qualified soil-testing agency, and approved by Construction Manager on the surface of the fine grade before installation of sod.

Roll sod. Final rolling process must provide uniform surface.

Contractor shall adjust grade irregularities as required. Irregularities of 1” will be the maximum acceptable tolerance.

Upon completion of final rolling, the lawn shall be watered frequently (typically 3 times per day) for 5-10 minutes or as weather conditions require. Do not water at night. Approval will be based on uniform, healthy and vigorous growth with no dry or dead spots in any new sod areas. Subsequent mowing on a regular basis shall be Contractor’s responsibility until Final Project Acceptance.

There is to be no sodding from June 15th through August 15th each year.

7.6 Preparation of Landscape Planting Areas:

Confirm with Construction Manager the layout of individual tree locations and areas for shrub and perennial plants. Stake locations, outline areas and secure Construction Manager acceptance before starting installation of work. Make minor adjustments as may be requested. All tree planting pit locations shall be dug deep enough to break through any existing clay pan, or to a depth as shown on planting details. Attain Construction Manager review of excavation before proceeding with work. Remove excess excavated material completely from job site and do not use any except as specified on landscape work at the project site.

Finish grade in all landscape areas shall be sloped away from any building and any surface drainage shall be directed as indicated on the Contract drawings.

Before back filling planting pits, clean any roots, plants, sod, stones, clay lumps, and other extraneous non-acceptable material harmful or toxic to plant growth from soil backfill.

Contractor to apply Ronstar Granular Pre-emergent Herbicide (or an approved equal) throughout all rock mulch areas prior to placing of weed fabric and mulch. No pre-emergent herbicide shall be applied in perennial or ground cover areas.

All planting beds shall be stripped and cleared of all lawn, roots, weeds, and debris and shall be raked to a smooth and even grade.

All planting holes shall either be hand or backhoe dug (no auger), and all sides shall be scarified. All holes shall be 3 times as wide as the rootball and back filled with existing soils and imported topsoil as specified in the landscape general notes or details.

Contractor to perform a percolation test in selected landscape planting areas. The test will consist of digging several planting pits to a specified size and filling them with water. If standing water is still remaining in pits after 30 minutes, contact Construction Manager for corrective drainage measures.

7.7 Cleanup and Protection:

During irrigation and landscape work, keep pavements clean and work area in an orderly condition, haul away and remove all debris from landscape areas daily and do not leave any pruning, name tags, clippings and/or other material. Keep all equipment, materials and other items used for or resulting from landscape work out of traffic and pedestrian areas.

Protect irrigation and landscape work and materials from damage due to landscape operations, operations by other Contractors and/or other trades. Maintain protection during installation and maintenance periods. Repair or replace damaged landscape work as directed or needed.

All grubbed and unusable material shall be removed from the site by the end of each working day.

Contractor to provide safety fencing or approved barricades to all excavations, depressions or obvious hazards when absent from the work site.

7.8 Protection of existing turf and trees:

1) Work limit lines shall be delineated per the Contract drawings, and construction shall be kept inside these boundaries.

2) Existing mature trees and turf adjacent to and on park property shall be protected from damage during construction by fencing or other means.

3) Any damage to existing turf, irrigation or trees shall be corrected at the expense of Contractor whose work has caused said damage.

4) Extreme caution shall be used in work around existing trees closest to the proposed project area.

5) As required, tree protection shall include the following measures:

a) No driving, parking, materials storage, dumping, cleaning of concrete trucks or other equipment, grading, compaction or other activity detrimental to the health of the tree shall be permitted in the protection zone.

b) Fencing or other high visibility material shall be erected to protect existing trees per Construction Manager's direction. If fencing is knocked down, it shall be replaced immediately. A "No Trespassing" / "no Entry" sign shall be placed outside the fencing.

c) The tree nearest the construction site shall be further protected by nailing 2x6 lumber to wire to create a rigid fencing material. This shall be secured around the trunk.

d) Trenching or rototilling shall not be permitted in the vicinity of the tree.

e) Any roots that are pruned must be cleanly cut. Ragged tears will not be permitted.

f) Do not leave roots exposed. Cover with dirt immediately to prevent drying out.

7.9 Maintenance:

Maintenance of the project area shall consist of and include furnishing all labor, materials, services, tools, equipment, water, and incidentals and performing all of the work required herein these specifications.

Begin maintenance upon completion of and immediately after installation of any landscape plant material or sod lawn areas.

Maintain all trees, shrubs and other plants until Final Project Acceptance. Construction Manager shall review health of trees and shrubs for Final Project Acceptance. No maintenance shall be performed by Contractor after Final Project Acceptance of the project, unless contracted to do so.

Mow (2" height) newly established sod lawn areas until Final Project Acceptance, and fertilize two (2) weeks after installation with an approved slow release fertilizer, as directed by Construction Manager.

Before Final Project Acceptance, inspect all landscape plantings once every two weeks (minimum) for under-watering, over-watering, insects and diseases. (Treat diseases and insect infestation as required).

Inspect drip irrigation system and spray heads for proper operation. Adjust if plant material shows stress

from under-watering or over-watering.

Maintain lawn areas, including watering, spot weeding, mowing, applications of herbicides, fungicides, insecticides, and re-sodding or re-seeding until a full, uniform stand of grass free of weeds, undesirable grass species, disease, and insects is achieved and has a Final Project Acceptance by Construction Manager.

Water sod areas daily (several short duration's) to maintain adequate surface soil moisture for proper sod rooting. Continue daily watering for twenty (20) to thirty (30) calendar days. Thereafter apply approximately ½" of water twice weekly until Final Project Acceptance.

Maintain all landscape planting bed areas, including trash pick-up, watering, spot weeding, applications of herbicides, fungicides and insecticides until weed-free planting beds are achieved and until Final Project Acceptance by Construction Manager.

Any dead plant material identified shall be replaced within 2 weeks.

All pruning shall be in accordance with the most recent edition of the ANSI A300 Pruning Standards.

7.10 Project Final Review and Acceptance:

After all the landscape work is completed Construction Manager , upon request (48 hour notice), will make a tour of the work to determine acceptability.

The landscape work may be reviewed for Final Project Acceptance, in parts or as agreeable to Construction Manager, provided maintenance work continues in areas not yet accepted as completed.

When reviewed, if the landscape work does not comply with Final Project Acceptance requirements, replace rejected work and continue maintenance until Construction Manager finds all work to be acceptable. Remove rejected plants and materials promptly from project site.

Sod lawn areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of the specified grass is established free of weeds, undesirable grass species, disease, and insects.

END OF DOCUMENT 9001

Document No. 9002 IRRIGATION SYSTEM (6/15/04)

1. General:

1.1 Description:

Drawings and General Conditions of these Contract documents, including Special Conditions apply to this section.

2. Summary:

This section includes the controller, backflow preventer, valves, piping, sprinklers, specialties, accessories, and wiring for a drip irrigation system for all planting bed areas and a spray irrigation system for all lawn areas.

Related Sections: The following Sections contain requirements that relate to this Section:

Document No. 9000 Landscape Grading of these Technical Specifications

Document No. 9001 Landscape of these Technical Specifications

3. Work Included:

The furnishing, installing, and testing of all specified material, equipment, necessary specialties and equipment, removal and/or restoration of existing elements, excavation and backfilling, and other work in accordance with these Contract documents as required for a fully functional irrigation system.

4. Definitions:

Pipe sizes used in this Section are nominal pipe size (NPS) in inches. Tube sizes are Standard size in inches.

Pressure Piping: Mainline piping downstream from water meter to and including control valves. Piping is under irrigation system pressure. Piping in this category includes a pressure regulator, flow sensor, master valve, and backflow preventer, isolation valves, and gate valves, when used.

Circuit Piping: Piping downstream from control valves to irrigation sprinklers. Piping is under pressure (less than pressure piping) during flow.

Control Valve: Automatic (electrically operated) valve for control of water flow to irrigation system zone.

5. System Performance Requirements:

Location of Irrigation Devices: Design location is approximate except for sprinkler head locations which are exact. Make minor adjustments necessary to avoid existing fencing, structures and obstructions.

Minimum Water Coverage: All turf areas and planting bed areas shall have 100% water coverage.

Components and Installation: Capable of producing piping systems with the following maximum working pressure ratings except where indicated otherwise.

1) Pressure Piping: 150 psi.

2) Circuit Piping: 100 psi.

The irrigation system has been designed to work at peak efficiency during the lowest water system pressure times. If Contractor has any concerns regarding the irrigation system's performance with the

available water pressure, immediately contact Construction Manager.

5. Submittals:

5.1 General:

Submit the following product data as specified in subsection 7.4 Shop Drawings and Quality Control/Inspections of the General Conditions.

5.2 Materials list:

Contractor shall provide a complete list of materials to Construction Manager. The list shall provide the item number, trade name, and corresponding catalog number. In conjunction with the list of materials, supportive data in the form of catalog sheets, specifications, or brochures giving complete and detailed information for each item shall be provided. Product data including pressure rating, rated capacity, settings, and electrical data of selected models for the following:

1) Master valve and flow sensor.

2) Air release valves.

3) Backflow preventer, including test equipment.

4) Pressure regulator, as required.

5) Valves, including general-duty, underground, manual and automatic control, and quick-coupler types, and valve boxes.

6) Sprinklers, including riser devices.

7) Controller, including controller wiring diagrams.

8) Field Control Wiring and direct burial shielded communication cable.

9) Strong box enclosures.

10) Central irrigation antenna equipment.

Wiring diagrams for electrical controllers, valves, and devices.

Any shop drawings showing requested changes to the irrigation system, including plan layout and locations, types, sizes, capacities, and flow characteristics of irrigation system components need to be submitted to Construction Manager in writing for review and approval. Include backflow preventers, valves, piping, sprinklers and devices, accessories, controller, and wiring. Show areas of sprinkler spray and over-spray.

One controller chart for each automatic controller supplied, showing the area covered by the controller. Controller chart to be hermetically sealed between two pieces of plastic and installed on controller door. The charts are to be a legible, reduced drawing of the actual as built system.

Maintenance data for inclusion in an “Operating and Maintenance Manual” for “project Closeout” for the following:

1) Master valve and flow sensor.

2) Backflow preventers, including instruction for testing.

3) Air release valves.

4) Pressure regulators.

5) Automatic control valves, quick coupler valves.

6) Sprinklers.

7) Controller.

8) Strong box enclosure.

9) Antenna equipment.

5.3 Quality Assurance:

Construction documents shall be on the site at all times while the irrigation system is being installed. Contractor shall make daily record of all work installed each day. Actual location of curb stop and waste valves, gate valves, quick coupling valves, electric valves, and mainline piping insolation valves shall be noted on the drawings by dimensions from easily identified permanent features such as building corners, curbs, fences, or property lines. The drawings shall be to scale and all notes and indications must be legible.

Comply with requirements of utility district supplying water for prevention of backflow and backsiphonage.

Installer Qualifications: Engage a licensed, bonded, and experienced Installer who has completed irrigation systems similar in material, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.

Listing/Approval Stamp, Label, or Other Marking: On equipment, specialties, and accessories made to specified standards.

Listing and Labeling: All equipment, specialties, and accessories that are installed on the project site shall be listed and labeled.

1) The Terms “Listed” and “labeled”: As defined in “national Electrical code,” Article 100.

2) Listing and Labeling Agency Qualifications: A “nationally Recognized Testing Laboratory” (NRTL) as defined in OSHA Regulation 1910.7.

Materials incorporated into this system shall be new and without flaws or defects and of quality and performance as specified and meeting the requirements of this system.

Product Options: Irrigation system piping, specialties, and accessories are based on specific types, manufacturers, and models indicated. Components with equal performance characteristics produced by other manufacturers may be considered, if submitted to Construction Manager and approved in writing prior to installation, provided deviations in dimensions, operation, and other characteristics do not change design concept or intended performance as judged by Construction Manager. The burden of proof of product equality is on Contractor.

Promptly repair damage to utilities, fencing, facilities, curbs, roadway pavement, or any site element structures caused by irrigation system work operations. Repairs are at Contractors expense.

5.4 Maintenance Period:

Contractor shall maintain controller, all valves, and devices included in the irrigation system as needed to keep the system in proper working order until Final Project Acceptance.

5.5 Warranties:

Contractor shall warrant all work including installation of the irrigation system, settling of trenches, controller panels, all valves, and devices for a period of one (1) year following Final Project Acceptance of the project. All manufacturers' extended warranties shall apply for the period provided by the manufacturer of the product.

5.6 Project Conditions:

Perform site inspection, verify existing utility locations and obtain worst case water pressure from the Utility District prior to starting work.

Site Information: Promptly notify Construction Manager of unexpected sub-surface or above ground conditions.

5.7 Sequencing and Scheduling:

Coordinate irrigation systems work with landscape work as specified in Document No. 9001 Landscape of these Technical Specifications.

There is to be no re-seeding and/or sodding from June 15th through August 15th of each year.

5.8 Extra Materials:

Deliver extra materials to Carson City. Furnish extra materials matching products installed. Package them with protective covering for storage and label clearly describing contents.

Sprinklers: Furnish quantity of units equal to 10 percent of amount of each type installed.

Valve Keys: Furnish quantity of tee-handle units equal to 25 percent of amount of each type key-operated, control valve installed.

Quick-Coupler Hose Swivels: Furnish quantity of units equal to 25 percent of amount of each type quick coupler installed.

Quick-Coupler Operating Keys: Furnish quantity of units equal to 25 percent of amount of each type quick coupler installed.

6. Products:

6.1 Manufacturers:

Subject to compliance with project requirements, Landscape Contractor must provide the following product. Carson City will not accept substitutions for this product.

Controller: Rain Master Evolution DX-2 Series Controller Assembly.

6.2 Available Manufacturers:

Subject to compliance with requirements and written authorization from Carson City, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

6.2.1 Backflow Preventers:

1) Watts Regulator Co.

2) Wilkins Regulator Div., Zurn Industries, Inc.

6.2.2 Pressure Regulators:

1) Watts Regulator Co.

2) Wilkins Regulator Div., Zurn Industries, Inc.

3) Cla-val

6.2.3 Gate Valves for Underground Installation:

1) Mueller Co., Grinnel Corp

2) Kennedy Valve Division, McWane Inc.

6.2.4 Valves:

1) Grinnell Supply Sales Co., Grinnell Corp.

2) Hammond Valve Div., Prairie Manufacturing Corp.

3) Watts Regulator Co.

6.2.5 Automatic Control Valves:

1) Rain Bird Sprinkler Mfg. Corp.

6.2.6 Control Valve Boxes with Bolt Down Lids:

1) Carson Industries, Inc.

6.2.7 Quick Couplers:

1) Rain Bird Sprinkler Mfg. Corp.

6.2.8 Sprinklers:

1) Hunter Industries

2) Rain Bird Sprinkler Mfg. Corp.

6.2.9 Backflow Preventer Enclosures:

1) Strong Box

6.2.10 Master Valve:

1) Superior

6.2.10 Flow Sensor:

1) Data Industrial

6.2.11 Air Release Valves:

1) Cla-Val

6.2.12 Pipes and Tubes:

All pipe shall be continuously and permanently marked with the following information: Manufacturers name or trademark, size, schedule and type of pipe, working pressure at 73 degrees F, and National Sanitation Foundation approval.

Refer to subsection Piping Applications of these Technical Specifications for identification of systems where pipe and tube materials specified below are used.

Polyvinyl Chloride (PVC) Plastic Pipe: ASTM D 1785, PVC 1120, Schedule 40, 160 psig minimum pressure rating for 8-inch and smaller sizes, with plain ends.

If reclaimed water is used, all pipe shall be purple in color.

6.2.13 Pipe and Tube Fittings:

Refer to subsection Piping Applications of these Technical Specifications for identification of systems where pipe and tube fitting materials specified below are used.

All SCH 80 plastic pipe fittings to be installed shall be molded fittings manufactured of the same material as the pipe and shall be suitable for solvent weld, slip joint ring tight seal, or screwed connections.

Cast-Brass Flanges: ASME B16.24, Class 150, raised ground face, bolt holes spot faced.

Polyvinyl chloride (PVC) Plastic Pipe fittings: ASTM D 2464, Schedule 80, threaded.

Polyvinyl chloride (PVC) Plastic Pipe Fittings: ASTM D 2467, Schedule 80, socket-type.

Dielectric Fittings: Assembly or fitting with insulating material isolating joined dissimilar metals to prevent galvanic action and stop corrosion. These devices are a combination of copper alloy and ferrous metal; threaded – and solder-end types, matching piping system materials.

1) Dielectric Unions: Factory-fabricated, union assembly, designed for 250 psig minimum working pressure at 180 deg F. Include insulating material isolating dissimilar metals and ends with inside threads according to ASME B1.20.1.

2) Dielectric Flanges: Factory-fabricated, companion-flange assembly for 150 psig or 300 psig minimum pressure to suit system pressures.

Transition Fittings: Manufactured assembly or fitting, with pressure rating at least equal to that of system and with ends compatible to piping where fitting is to be installed.

6.2.14 Joining Materials:

Solvent Cement: ASTM F 656 primer and ASTM D 2564 solvent cement in color other than orange.

6.2.15 Backflow Preventers:

6.2.16 Definition:

An approved Backflow Prevention Assembly means an assembly that has been manufactured in full conformance with the standards established by the American Water Works Association (AWWA), entitled: AWWA C506, (current revision) Standards for Reduced Pressure Principle and Double Check Valve Backflow Prevention Devices; and have passed laboratory and field evaluation tests performed by a recognized testing organization which has demonstrated their competency to perform such a test to the department.

6.2.17 Description:

ASSE Standard Backflow preventers, of size indicated for maximum flow rate and maximum pressure loss indicated.

1) Working Pressure: 150 psig minimum except where otherwise indicated.

2) Interior components: Corrosion-resistant materials.

3) Strainer supplied with and compatible for size and capacity with unit, or inlet, where strainer is indicated.

Backflow Preventer, ASSE 1013, with (OS & Y) gate valves on inlet and outlet and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A 112.1.2 air-gap fitting located between 2 positive-seating check valves for continuous pressure application.

1) Pressure Loss: 15 psig maximum, through middle third of flow range.

2) Gate valves supplied with and compatible for size and testing of unit on inlet and outlet.

3) Test Kit: Unit manufacturer supplied, complete calibrated backflow preventer testing equipment kit with carrying case.

6.2.18 Pressure Regulators:

6.2.19 Description:

ASSE 1003, single-seated, direct-operated type water pressure regulators, rated for initial working pressure of 150 psig minimum, with size, flow rate, and inlet and outlet pressure indicated. Include integral factory-installed or separate field-installed Y-pattern strainer that is compatible with unit for size and capacity.

Interior Components: Corrosion-resistant materials.

6.2.20 Valves:

General: Valves are for general-duty and underground applications.

Curb Stops: Brass body, ground key plug or ball, 150 psig minimum pressure rating, wide tee head, with inlet and outlet to match service piping material.

Gate Valves 2 ½ " and larger shall be Cast-Iron, Rising Stem Gate Valves: MSS SP-70, Type 1, solid wedge disc; rising stem and flanged ends. Include all brass trim; Class 125, ASTM A 126, cast-iron body; and star top handle.

Gate Valves 2" or smaller shall be brass, Rising-Stem Gate Valves: MSS SP-80, Type 2, solid wedge; rising, copper-silicon-alloy stem; Class 125, body and screw bonnet of ASTM B 62 cast brass, with threaded or solder-joint ends. Include polytetrafluoroethylene (PTFE)-impregnated packing, brass packing gland, and malleable-iron with star top handle.

Plastic Valves: Polyvinyl Chloride (PVC) plastic, with 150 psig minimum pressure rating, ends compatible to piping where valve is to be installed, and tee handle.

6.2.21 Control Valves:

6.2.22 Description:

Manufacturer's standard control valves for circuits, of type and size indicated, and as follows:

1) Automatic Control Valves: Diaphragm-type, normally closed, with manual flow adjustment, and operated by 24-volt-a.c. solenoid.

2) Quick-Couplers: Factory-fabricated, 2-piece assembly. Include coupler water-seal valve; removable upper body with spring-loaded or weighted, rubber-covered cap; hose swivel with ASME B1.20.7, ¾-11.5NH threads for garden hose on outlet; and operating key.

a) Locking Top Option: Include vandal-resistant, locking feature with 2 matching keys.

6.2.23 Control Valve Boxes:

Cover marked "IRRIGATION". Size as required for application.

1) If reclaimed water is used, box shall be purple in color.

2) Drainage Backfill: Cleaned rock, 6 inch depth minimum.

3) Provide all necessary bolts to secure valve box lids.

4) Provide concrete bricks under valve box to prevent settling and level to finish grade.

6.2.24 Sprinklers;

Description: Manufacturer's standard sprinklers designed to provide uniform coverage over entire area of spray shown on Contract Drawings at available water pressure, as follows:

1) Housings: Plastic.

2) Flush, Surface: Screw-type flow adjustment.

3) Interior Parts: Brass or other corrosion-resistant materials.

4) Pop-Up, Spray: Fixed pattern, with screw-type flow adjustment and stainless-steel retraction spring.

6.2.25 Automatic Control System:

Description: Low-voltage controller system, made for control of irrigation system automatic control valves. Controller operates on 120 volts a.c. power system, provides 24 volts a.c. power to control valves, and includes stations for at least the number of control valves indicated.

Exterior Control Enclosures: Weatherproof enclosure with locking cover and 2 matching keys. Enclosure construction complies with NFPA 70 and NEMA 250, Type 4, and includes provisions for grounding.

Transformer: Internal-type, and suitable for converting 120 volts a.c. power to 24 volts a.c. power.

Controller Stations for Automatic Control Valves: Each station is variable from approximately 5 to 60 minutes. Include switch for manual or automatic operation of each station.

Timing Device: Adjustable, 24-hour, 14-day clock to operate any time of day.

Wiring: UL 493, solid copper conductor, insulated cable, suitable for direct burial.

1) All valve and control wires shall be individually labeled and numbered at all valve box locations.

They shall be labeled with pan code wire markers.

2) Low-Voltage Circuit Cables: Type UF, No. 12 AWG minimum, between controllers and automatic control valves. Three extra sets of valve wires to be different color for ground wire and field wire. Furnish cables with jackets of different colors for multiple cable installation in same trench.

3) Splicing Materials: Pressure-sensitive thermoplastic tape and other materials required to make specified connections.

4) Connect each remote control valve to one station of a controller except as otherwise indicated.

5) Connect remote control valves to a common ground wire system independent of all other controllers.

6) Make wire connections to remote control electric valves and wire splices using King Wire Splice Connectors (or approved equal).

7) Provide tight joints to prevent leakage of water and corrosion build-up on the joint.

8) Control wire shall be copper #12-1 AWG UF RHH with maximum voltage dip of 5% between valve and controller. Control wire shall have jacket color of red. Common ground wire shall be copper #12-1 AWG UF RHH and shall have an insulating jacket, color white. Splices shall be made with King Wire Splice Connector #KWC 100 or approved equal.

6.2.26 Concrete Bases/Thrust Blocks:

Concrete: Portland cement mix, 3000 psi.

1) Cement: ASTM C 150, Type 1.

2) Fine Aggregate: ASTM C 33, sand.

3) Coarse Aggregate: ASTM C 33, crushed gravel.

4) Water: Potable.

Reinforcement: Steel conforming to the following:

1) Reinforcement Bars: ASTM A 615 Grade 60, deformed.

6.2.27 Reclaimed Water Signage:

If reclaimed water will be used, Contractor will be responsible for the installation of all required warning signage at the project site as directed by Carson City Public Works Department and NDEP.

6.2.28 Identification:

Plastic underground detectable warning tape shall be placed 12 inches above mainline and control wires. If reclaimed water is used, tape shall be labeled reclaimed water and shall be purple.

7. Execution:

7.1 Examination:

Before proceeding with any work Contractor shall verify all dimensions and quantities for any discrepancy between the drawings and specifications and the existing conditions. Notify Construction Manager if there are any problems. Work shall not proceed if a discrepancy is found until approval to proceed has been

given by Construction Manager.

7.2 Preparation:

Set stakes to identify proposed piping, valves and sprinkler locations. Obtain Construction Manager's approval before excavation.

Protect existing fence and other features designated to remain as part of the final irrigation work.

7.3 Excavation, Trenching and Backfilling:

Contractor shall excavate to a depth shown on the drawings. Excavated material not required for backfill shall be promptly removed from the project site. Dispose of in a proper, legal manner.

Trenching shall be performed as detailed on the irrigation drawings.

1) Excavate straight and true with trench bottom uniformly sloped.

2) Trench walls shall be vertical and of open construction at a width so as to provide proper installation of the pipe.

3) Keep trenches free of rocks, debris, material, or any obstructions that may damage pipe.

4) Bottom of trench shall be excavated three inches below the required grade so that the pipe can be laid on a compacted bed of imported Type A Bedding Sand.

7.4 Backfilling:

1) Use only selected material that is either sand, pit run, or excavated material that contains no rocks larger than 1 inch in diameter.

2) Backfill material shall be installed in 4 – 6 inch lifts with each lift being thoroughly moistened and compacted to a relative density of not less than ninety-five percent by the use of hand tampers. No water jetting shall be allowed.

3) Keep trenches free of debris, material, or obstructions that may damage pipe.

4) Dress backfilled areas to original grade. Rehabilitate trenches and impacted surrounding turf by raking and seeding with Agrono-Tec brand Ballfield 4A seed mix. (1-800-543-4109) Apply at a rate equal to a minimum 12 pounds per 1,000 square feet.

5) Native soil may be used for backfill material. If additional topdressing material is necessary, it shall be Nevada Organics Premium Topsoil Mix. (775-882-9500)

7.5 Piping Applications:

Refer to subsection Products of these Technical Specifications for detailed specifications for pipe and fittings products listed below. Piping in pits and above ground may be joined with flanges instead of joints indicated.

Use pipe, tube, fittings, and joining methods according to the following applications.

Pressure Piping Underground: Use the following:

1) 4 Inches and Smaller: ASTM D 1785, Schedule 40, Polyvinyl Chloride (PVC) plastic pipe; ASTM D 2467, schedule 80, PVC plastic, socket-type pipe fittings; and solvent-cemented joints.

Circuit Piping: Use the following:

1) All Sizes: ASTM D 1785, schedule 40, Polyvinyl Chloride (PVC) plastic pipe; ASTM D 2466, Schedule 80, PVC plastic, socket-type fittings; and solvent cemented joints.

Branches and Offsets at Sprinklers and Devices: ASTM D 1785, Schedule 40, Polyvinyl Chloride (PVC) plastic pipe with threaded ends; ASTM D 2464, Schedule 80, PVC plastic, threaded fittings; and threaded joints.

Sleeves: ASTM D 1785, Schedule 40, Polyvinyl Chloride (PVC) plastic pipe; ASTM D 2466, Schedule 80, PVC plastic, socket-type fittings; and solvent-cemented joints.

7.6 Joint Construction:

Threaded Joints: Thread pipes with tapered pipe threads according to ASME B1.20.1, apply tape, and apply wrench to valve ends into which pipes are being threaded.

Polyvinyl Chloride (PVC) Piping Solvent-Cemented Joints: Construct joints according to ASTM D 2672 and ASTM D 2855.

1) Handling of Solvent Cements, Primers, and Cleaners: Comply with procedures in ASTM F 402 for safe handling when joining plastic pipe and fittings with solvent cements.

Dissimilar Materials Piping Joints: Construct joints using adapters that are compatible with both piping materials, outside diameters, and system working pressure. Refer to subsection Piping Systems – Common Requirements of these Technical Specifications for joining dissimilar metal piping.

7.7 Piping Systems – Common Requirements:

General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

Install piping at a uniform slope, free of sag and bends.

Install components having pressure rating equal to or greater than system operating pressure.

Locate groups of pipes parallel to each other, spaced to permit valve servicing.

Install fittings for changes in direction and branch connections.

Manifold Piping Connections: Except as otherwise indicated make piping connections as specified below.

1) Install unions, in piping 1 inch or smaller, adjacent to each drip valve.

7.8 Piping Installation:

Install piping in excavated trenches as detailed on the drawings.

Pipe sizes shall conform to those on the drawings. No substitutions of smaller pipe sizes will be permitted.

All pipe damaged or rejected because of defects shall be removed from the site at the time of rejection.

Piping locations shown on the drawings are approximate. Final locations of all piping shall be established by Contractor and approved by Construction Manager.

Install underground Polyvinyl Chloride (PVC) plastic pipe according to ASTM D 2774.

Lay piping on solid subbase, uniformly sloped without humps or depressions.

1) Install Polyvinyl Chloride (PVC) plastic pipe in dry weather when temperature is above 40 deg F. Allow joints to cure at least twenty-four (24) hours at temperature above 40 deg F before testing, unless otherwise recommended by manufacturer.

Drain Pockets: Excavate to sizes indicated. Backfill with clean gravel or crushed stone, graded to ¾ inch minimum, drain material to be 6 inch depth. Cover drain material with sheet of ASTM D 226, Type II, asphalt-saturated felt, or an approved equal, and backfill remainder with excavated material.

Minimum Cover: Provide following minimum cover over top of buried piping:

1) Pressure Piping: Depth to be a minimum of 24 inches below finished grade.

2) Circuit Piping: 18 inches.

3) Sleeves: 18 or 24 inches.

4) Install piping under sidewalks and paving in sleeves.

7.9 Valve Installation:

Valves: Install underground valves in valve boxes.

Curb Stops: Install underground curb stops in valve boxes

Control Valves: Install in control valve boxes, arranged for easy adjustment and removal. Provide sufficient field wire slack at site connections to allow raising the valve bonnet to the surface without disconnecting the wires when repair is required.

7.10 Backflow Preventer Installation:

Install a backflow preventer of type, size and capacity indicated. Include valves and test cocks. Install according to plumbing code and health department authorities with jurisdiction.

Install backflow preventer a minimum of 12 inches above finished grade.

Support backflow preventer, pressure reducing valve, and piping on 3000-psi minimum, Portland-cement-mix concrete footing/thrust block.

Testing: After final installation of the backflow preventer, the equipment must be tested by a certified tester within five (5) calendar days of the water meter set date and/or before Final Project Acceptance, whichever occurs first.

Preform a static pressure test in the presence of Construction Manager prior to any downstream assembly of the backflow preventer to determine the possible need for a pressure regulator.

7.11 Pressure Regulator Installation:

If required, install pressure regulator on downstream side of backflow preventer.

7.12 Valve Boxes:

Install valve boxes as detailed and where indicated on drawings.

7.13 Sprinkler Installation:

Sprinklers: Flush circuit piping with full head of water and install sprinklers.

1) Install lawn sprinklers at manufacturer's recommended heights.

2) Install planting area sprinklers at heights indicated.

3) Locate part-circle sprinklers in landscape planting beds to maintain a minimum distance of 6 inches from building and 1 inch from other boundaries, unless otherwise indicated.

Sprinkler patterns shall be as indicated on the drawings.

7.14 Automatic Control System Panel Installation:

Install controller according to manufacturer's written instructions and as indicated on the drawings.

Install control wiring in same trench with mainline piping.

1) Wires shall be a minimum of 1' from any pipe or fitting, except when taped to mainline. Provide 3' loop slack at valves, and zig zag wires in trench to allow for contraction of wire. Control wires shall be wrapped at 10 foot intervals with plastic electrical tape with a minimum of 5-6 turns.

7.15 Connections:

Connect piping to sprinklers, devices, valves, control valves, specialties, and accessories.

Connect water supplies to irrigation systems. Include backflow preventers on potable water supplies.

Electrical Connections: Connect to existing power source, controller, and automatic control valves.

7.16 Field Quality Control:

Testing: Demonstrate to Construction Manager a hydrostatic test of piping and valves before backfilling trenches. Piping may be tested in sections to expedite work.

1) Cap and subject the piping system to a static water pressure of 1.5 times normal static water pressure. Allow to stand to two (2) hours. Leaks and loss in test pressure constitute a test failure. Contractor to fix defects that must be repaired at the expense of Contractor.

2) Repair leaks and defects with new materials and retest system or portion thereof in the presence of Construction Manager until satisfactory results are obtained and the system is approved.

3) Inspections: Refer to the drawings for detailed inspection requirements.

4) Notify Construction Manager two (2) working days in advance to schedule a Hydrostatic Pressure Test.

7.17 Cleaning and Adjusting:

Flush dirt and debris from piping before installing sprinklers and other devices.

Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.

Carefully adjust lawn sprinklers so they will be flush with finish grade after completion of landscape work.

Adjust settings of controllers and automatic control valves.

7.18 Final Project Acceptance:

Starting Procedures: Follow manufacturer's written procedures. If no procedures are prescribed by manufacturers, proceed as follows:

1) Verify that specialty items and their accessories have been installed correctly and operate correctly.

2) Verify that specified tests of piping are complete.

3) Check that valves, sprinklers and other devices are correct type.

4) Check that damaged sprinklers and devices have been replaced with new materials.

5) Check that potable water supplies have specified backflow preventers.

6) Energize circuits to electrical equipment and devices.

7) Adjust operating controls.

Operational Testing: Perform operational testing after hydrostatic testing is completed, backfill is in place, and sprinklers are adjusted to final position.

7.19 Demonstration:

Demonstrate to Construction Manager that the system meets coverage requirements and the automatic controls function properly.

Demonstrate to Carson City's maintenance personnel operation of equipment, sprinklers, specialties, and accessories. Review operating and maintenance information.

Provide two (2) working days written notice in advance of demonstration.

END OF DOCUMENT 9002

END OF TECHNICAL SPECIFICATIONS